

MICHIGAN STATE
U N I V E R S I T Y

ELECTRONIC BIDDING

MSU BASE CONTRACTORS ONLY
SPECIFICATION FOR

OWEN GRADUATE HALL – WEST- CONVERT OFFICE SPACE TO FRIB HOUSING

PROJECT NUMBER

CP22127

Thursday, June 08, 2023

AT

MICHIGAN STATE UNIVERSITY
EAST LANSING, MICHIGAN

Infrastructure Planning and Facilities
Planning, Design and Construction

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<http://procedures.ipf.msu.edu/procedures.ipf.msu.edu/index.cfm/capital-project-delivery-procedures/index.html>

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SCHEDULE OF DRAWINGS

Project Title: **OWEN GRADUATE HALL – WEST- CONVERT OFFICE SPACE TO FRIB HOUSING**

Capital Project Number: **CP22127**

No. of Sheets: **18**

ADVERTISEMENT FOR BIDS

DATE: **June 8, 2023**

PROJECT TITLE: **OWEN GRADUATE HALL – WEST - CONVERT OFFICE SPACE
TO FRIB HOUSING**

PROJECT NUMBER: **CP22127**

for

MICHIGAN STATE UNIVERSITY

located at

EAST LANSING, MICHIGAN

OWNER: **BOARD OF TRUSTEES
MICHIGAN STATE UNIVERSITY**

ENGINEER/ARCHITECT: **PLANNING, DESIGN AND CONSTRUCTION
Infrastructure Planning and Facilities
Michigan State University**

DESIGN REPRESENTATIVE: **Tony Gibson PHONE: 517.432.0501**

CONSTRUCTION
REPRESENTATIVE: **Tony Gibson PHONE: 517.432.0501**

**WTA Architects
100 S. Jefferson Avenue, Suite 601
Saginaw, Michigan 48607**

BID DUE DATE: Until 3:30 p.m. on **Wednesday, July 19, 2023**, the Owner will receive bids for the work as set forth in the Bidding Documents at via the Owner's Oracle Primavera Unifier Bid Manager, at which time and place all proposals will be publicly opened. Bidders are responsible for properly registering for this process and familiarizing themselves with the system and its requirements. Registration information can be found at <https://ipf.msu.edu/construction/partners/prospective-partners>.

Proposals are invited for the following work:
Proposal 1 – General Construction Work

AB-2
ADVERTISEMENT
FOR BIDS

This project involves the conversion of office space into student rooms on the first floor of Owen Graduate Hall – West. Minor plan revisions will be made with finish upgrades to the bedrooms, bathrooms, and corridor.

This project is to be bid by MSU base contractors only.

The substantial construction completion date for the project, as set forth in the project manual and drawings is **December 22, 2023**. The date is a firm date – bid is to include work necessary to maintain construction schedule. See applicable start date and interim completion dates in the General Requirements (Division One) – Part 1 Work Sequence section.

LIQUIDATED DAMAGES:

Shall, or Shall not be assessed for Substantial Completion at:
\$_____PER DAY

Shall, or Shall not be assessed for Final Completion at:
\$_____PER DAY

EXCLUSIONS FROM MUTUAL WAIVERS OF CONSEQUENTIAL DAMAGES: NONE.

The complete set of documents is also available for viewing through our new [MSU Plan Room](#) or via the MSU Planning, Design and Construction (PDC) web page at <https://ipf.msu.edu/construction/partners/prospective-partners>, and then select “Construction projects out to bid”.

PLAN ROOMS

The Bidding documents are on file and may be examined at the following locations during regular business hours, Monday through Friday:

Builders Exchange of Lansing &
Central Michigan
1240 East Saginaw
Lansing, MI 48906

Dodge Data & Analytics
25330 Telegraph Road, Suite 350
Southfield, MI 48009

Dodge Data & Analytics
914 E. Vine Street
Kalamazoo, MI 49001

Dodge Data & Analytics
1311 South Linden Road, Suite B
Flint, MI 48532

Builders Exchange
P.O. Box 2031
Grand Rapids, MI 49501

Tri-City Builders & Traders Exchange
334 South Water
Saginaw, MI 48607

Construction Association of Michigan
43636 Woodward Avenue
P. O. Box 3204
Bloomfield Hills, MI 48302-3204

Builders Exchange
3431 East Kilgore
Kalamazoo, MI 49001

CNS Construction News Service
of West Michigan, Inc.
1793 R. W. Berends Dr. SW.
Wyoming, MI 49509-4993

MMSDC Michigan Minority Supplier
Development Council.
100 River Place STE 300
Detroit, MI 48207

Builders Exchange of NW MI, Inc.
1373 Barlow St., Suite 4
Traverse City, MI 49686

Capital Imaging
2521 East Michigan Avenue
Lansing, MI 48912

AB-4
ADVERTISEMENT
FOR BIDS

A pre-bid site inspection will be held on **Tuesday, June 27, 2023** at **10:00 a.m.**. All interested Contractors or Bidders are encouraged to attend. Interested parties should meet at the **main entrance of Owen Graduate Hall, 735 E. Shaw Lane, East Lansing, MI 48825**. All Contractors submitting bids for the work will be held to have visited the site prior to submitting bids.

Each proposal shall be accompanied by a bid security as set forth in the Instructions to Bidders.

The Owner reserves the right to reject any or all proposals either in whole or in part and to waive any irregularities.

Withdrawal of any proposal is prohibited for a period of 120 days after the actual date of the opening thereof.

Performance and Labor and Material Bonds are required as set forth in the Instructions to Bidders.

All prospective Bidders, their Subcontractors and suppliers must be awardable by and in compliance with the directives and guidelines of the Contract Compliance Division of the Michigan Civil Rights Commission.

SUBCONTRACTING AND SUPPLIER DIVERSITY

The University makes a continuous effort to broaden its business relationships with Minority Business Enterprise (MBE) contractors, Women Business Enterprise (WBE) contractors, and small business concerns (including veteran-owned small business, service-disabled veteran owned small business, HUB Zone small business, and small disadvantaged business concerns certified by the U.S. Small Business Administration). For the purposes of this provision, suppliers are considered subcontractors. If third parties are needed to fulfill contractual obligations to the University, you are strongly encouraged to consider all qualified sources, including WBE, MBE, and small business subcontractors. For purposes of this paragraph, MBE is defined as a business enterprise of which more than 50% of the voting shares or interest in the business is owned, controlled, and operated by individuals who are members of a minority and with respect to which more than 50% of the net profit or loss attributable to the business accrues to shareholders who are members of a minority. WBE is defined as a business enterprise of which more than 50% of the voting shares or interest in the business is owned, controlled, and operated by women and with respect to which more than 50% of the net profit or loss attributable to the business accrues to the women shareholders.

The apparent Low Bidder shall, within 24 hours, after receipt of bids, provide the names of any MBE/WBE/small business subcontractors, description of work to be done by each, dollar value of work, and percentage of contract price. This information shall be included with the contract breakdown specified in Section 012000.1.4 of the specifications.

The Michigan State University Purchasing Department maintains a list of known Minority and Women Business Enterprises in the region for informational purposes. Bidders can obtain a copy of this list by calling (517) 355-0357. This list is not intended to be comprehensive. Similarly, it does not constitute an endorsement or certification of acceptability of the contractors and vendors included.

INSTRUCTION TO BIDDERS

ARTICLE 1

DEFINITIONS

- 1.1 Bidding Documents include the Advertisement or Invitation to Bid, Instruction to Bidders, the Bid Form, other sample bidding and Contract forms and the proposed Contract Documents including any Addenda issued prior to receipt of Bids.
- 1.2 All definitions set forth in ConsensusDocs 200- Standard Agreement and General Conditions Between Owner and Constructor (as modified by MSU) and in other Contract Documents are applicable to the Bidding Documents.
- 1.3 **Addenda** are written or graphic instruments, issued by the Architect prior to the receipt of Bids, which modify or interpret the Bidding Documents by addition, deletions, clarifications or corrections.
- 1.4 A **Bid** is a complete and properly signed proposal to do the Work or designated portion thereof, for the sums stipulated therein, supported by data called for by the Bidding Documents.
- 1.5 **Base Bid** is the sum stated in the Bid for which the Bidder offers to perform the Work described as the base, to which Work may be added or deducted for sums stated in Alternate Bids.
- 1.6 An **Alternate Bid** (or Alternate) is an amount stated in the Proposal to be added to or deducted from the amount of the Base Bid if the corresponding change in project scope or materials or methods of construction described in the Bidding Documents is accepted.
- 1.7 A **Unit Price** is an amount stated in the Bid as a price per unit of measurement for materials or services as described in the Contract Documents.
- 1.8 A **Bidder** is one who submits a Bid for a prime Contract with the Owner for the Work described in the proposed Contract Documents.
- 1.9 A **Sub-bidder** is one who submits a Bid to a Bidder for materials or labor for a portion of the Work.
- 1.10 **Bid Manager** is the Oracle Primavera Unifier Bid Manager application used the by the Owner to received competitive bids for this project.

ARTICLE 2

BIDDER'S REPRESENTATION

- 2.1 Each Bidder, by making his/her Bid, represents that:
- 2.1.1 They have read and understand the Bidding Documents and their Bid is made in accordance therewith.
 - 2.1.2 They have visited the site and are familiar with the local conditions under which the Work is to be performed.
 - 2.1.3 Their Bid is based upon the materials, systems and equipment described in the Bidding Documents, without exceptions.

ARTICLE 3

BIDDING DOCUMENTS

3.1 COPIES

3.1.1 Bidders may obtain complete sets of the Bidding Documents via the MSU PLANNING, DESIGN AND CONSTRUCTION web page at <https://ipf.msu.edu/construction/partners/prospective-partners>, or as outlined in the Advertisement for Bids, page AB-2.

- 3.1.2 Complete sets of Bidding Documents shall be used in preparing Bids; neither the Owner nor the Architect assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 3.1.3 The Owner or Architect, in making copies of the Bidding Documents available on the above terms, does so only for the purpose of obtaining Bids on the Work and does not confer a license or grant for any other use.

3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

- 3.2.1 Bidders shall promptly notify the Architect of any ambiguity, inconsistency or error which they may discover upon examination of the Bidding Documents or of the site and local conditions.
- 3.2.2 Bidders requiring clarification or interpretation of the Bidding Documents shall make a written request to be received by the Architect at least fourteen days prior to the date for receipt of Bids.
- 3.2.3 Any interpretation, correction or change of the Bidding Documents will be made by Addendum. Interpretations, corrections or changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections and changes.

3.3 SUBSTITUTIONS

- 3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.
- 3.3.2 No substitution will be considered unless written request for approval has been submitted by the Bidder and has been received by the Architect at least fourteen days prior to the date for receipt of Bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data, and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment or work that incorporation of the substitute would require shall be included. It is the burden of the bidder proposing the substitution to establish its merits. The Architect's decision of approval or disapproval of a proposed substitution shall be final.
- 3.3.3 If the Architect approves any proposed substitution, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

3.4 ADDENDA

- 3.4.1 The Architect and Owner will endeavor to notify all known plan holders of addenda issued, but it is the Bidder's responsibility to verify receipt of all addenda.
- 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.
- 3.4.3 Normally Addenda will not be issued later than five days prior to the date for receipt of Bids except an Addendum, if necessary, postponing the date for receipt of Bids or withdrawing the request for Bids.
- 3.4.4 Each Bidder shall ascertain prior to submitting their Bid that they have received all Addenda issued, and receipt of all Addenda shall be acknowledged on their bid.

ARTICLE 4

BIDDING PROCEDURE

4.1 FORM AND STYLE OF BIDS

- 4.1.1 Bids shall be submitted via the Bid Manager on the form specified.
- 4.1.2 All fields on the Bid Form shall be completed.
- 4.1.3 All requested Alternates shall be listed and quoted in the Bid Manager. Failure to quote a requested Alternate will be cause to reject the Bid.

4.1.3.1 If an alternate is added via Addendum, bidders will include by adding new line to bid form, clearly labeling ALTERNATE X(x being the number).

4.1.4 All requested Unit Prices shall be listed and quoted via attachment in the Bid Manager. Failure to quote a requested Unit Price will be cause to reject the Bid.

4.1.5 Acknowledge the receipt of the last Addendum on the Bid Form. By acknowledging this addendum, Bidder also acknowledges receipt of all prior consecutive addenda (e.g., acknowledging Addendum 3 also acknowledges Addendum 1 and 2).

4.1.6 Bidder shall make no additional stipulations on the Bid Form nor qualify its Bid in any manner.

4.1.7 By submitting a Bid via the Bid Manager, the Bidder has committed the offer to perform the Work. The Owner will rely on this document as properly signed by the Bidder. The Owner may rely on this commitment, including submitting a claim on the Bidder's Bid Bond if they fail to enter into a contract per the project manual.

4.2 BID SECURITY

4.2.1 Any base bid greater than \$50,000 shall be accompanied by a Bid Security in the form of a bid bond made payable to the Board of Trustees, Michigan State University, in the amount of not less than five percent (5%) of the Base Bid, as a proposal guarantee, pledging that the Bidder will enter into a Contract with the Owner on the terms stated in its Bid, and will furnish bonds as described hereunder in Article 8 covering the faithful performance of the Contract and the payment of all obligations arising thereunder. Bidder shall attach a scanned copy of the bid bond to the bid in Unifier Bid Manager.

As an alternative to a bid bond, Bidders may provide certified check, cashiers' check, or money order made payable to the Board of Trustees, Michigan State University, in the amount of not less than five percent (5%) of the Base Bid, to be delivered to MSU Infrastructure Planning and Facilities, 1147 Chestnut Road, Room 101, East Lansing, MI 48824. The proposal guarantee of Bidders under consideration will be returned immediately after approval of contracts by the Owner; those of all others will normally be returned upon request within 48 hours after bid opening.

Should the Bidder refuse to enter into a Contract or fail to furnish such bonds within 30 days of notification of intent to award, the amount of the Bid Security shall be forfeited to the Owner as liquidated damages, not as penalty.

4.2.2 The bonding firm must be listed on the current U.S. Department of Treasury Circular 570, rated A- or better by Best, and be licensed to do business in the State of Michigan. The bonds are to be made out to "Michigan State University, Board of Trustees."

4.2.3 The Owner will have the right to retain the Bid Security of Bidders under consideration until either (a) the Contract has been executed and bonds have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn, or (c) all Bids have been rejected.

4.3 SUBMISSION OF BIDS

- 4.3.1 Bids shall be completed prior to the time and date for receipt of Bids indicated in the Advertisement or Invitation to Bid, or any extension thereof made by Addendum. Bids received after the time and date for receipt of Bids will not be considered.
- 4.3.2 Bidder shall assume full responsibility for timely delivery at location designated for receipt of Bids.
- 4.3.3 Oral, telephone, paper, or faxed Bids are invalid and will not receive consideration.

4.4 MODIFICATION OR WITHDRAWAL OF BID

- 4.4.1 A Bid may not be modified, withdrawn, or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and Bidder so agrees in submitting his/her Bid.
- 4.4.2 Prior to the time and date designated for receipt of Bids, Bids submitted early may be modified or withdrawn only by withdrawing current Bid, and resubmitting within the Bid Manager.
- 4.4.3 Bid security shall be in an amount sufficient for the Bid as modified or resubmitted.

4.5 BIDDER REGISTRATION

- 4.5.1 The Owner will only receive Bids via the Bid Manager, which requires prior registration and invitation. The Bidder is responsible to familiarize itself with this system and request access in a timely manner.
- 4.5.2 The Owner will endeavor to maintain a list of all interested bidders and invite to all public bids. Bidders interested in being added to this list must register. Registration information can be found at <https://ipf.msu.edu/construction/partners/prospective-partners>.
- 4.5.3 Bidders are encouraged to continue to monitor projects via plan rooms and other advertising venues. They must express interest to bid on MSU projects by request at least 7 days prior to a bid opening. Owner takes no responsibility for inviting a bidder after that date.

ARTICLE 5

CONSIDERATION OF BIDS

5.1 OPENING OF BIDS

- 5.1.1 Unless stated otherwise in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be opened publicly and will be read aloud. Opening will generally take place in MSU Infrastructure Planning and Facilities Building, 1147 Chestnut Road, East Lansing, Michigan 48824.

5.1.1.1 Unless stated otherwise in the Advertisement or Invitation to Bid, the Owner will endeavor to share bid results within 24 hours of opening.

5.1.1.2 The Owner will endeavor to stream the bid opening, and will share details in the bid invitation

5.2 REJECTION OF BIDS

5.2.1 The Owner shall have the right to reject any or all Bids.

5.3 ACCEPTANCE OF BID (AWARD)

5.3.1 The Owner shall have the right to waive any informality or irregularity in any Bid received.

5.3.2 If the University accepts any alternates, it will do so in the order representing the Owner's opinion of the best value to Michigan State University. The Owner shall be the sole judge of value. The low bidder will be determined on the basis of the sum of the base bid and the alternates accepted.

5.4 ACCEPTANCE OF CONTRACTOR AND SUBCONTRACTORS

5.4.1 Each portion of the Work shall be performed by an organization equipped and experienced to do the Work in each particular field, and no portion shall be reserved by the Contractor unless they are so equipped and experienced. Within 24 hours after the receipt of Bids, the successful Contractor shall submit a list of each Subcontractor proposed for each section of the Work. Subcontractors shall be satisfactory to the Owner. Unless authorized to the contrary in writing from the Owner, Subcontracts shall be awarded to the firms named in this list. Acceptance of the Bid does not imply approval of the Subcontractors subsequently named, but each Subcontractor shall be approved individually.

ARTICLE 6

QUALIFICATION OF CONTRACTORS

6.1 SUBMISSION OF QUALIFICATION STATEMENT

6.1.1 Bidders to whom award of a Contract is under consideration shall submit to the Architect upon his/her request, a properly executed Contractor's Qualification Statement, Consensus Docs 221 – Constructor's Statement of Qualifications for a Specific Project, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

6.2 NONDISCRIMINATION

6.2.1 In performing under this Contract, the Contractor agrees not to discriminate against any employee, or applicant for employment, with respect to hire, tenure, terms, conditions or privileges of employment, or any matter directly or indirectly related to employment, because of race, color, religion, national origin, age, sex, height or weight, marital status or handicap. Subcontracts with each Subcontractor will contain a provision requiring nondiscrimination in employment, as herein specified. Any breach of this covenant may be regarded as a material breach of this Contract. The foregoing is included as a part of the University's institutional Affirmative Action/Equal Opportunity commitment.

6.3 APPROVED ASBESTOS ABATEMENT CONTRACTORS

6.3.1 The Department of Environmental Health and Safety (EHS) annually prequalifies asbestos abatement contractors to perform asbestos abatement work on Campus. Asbestos abatement work shall only be performed by one of the asbestos abatement contractors on the approved list. The current list is available from the PDC Project Representative, the Environmental Coordinator for EHS, and at <https://ehs.msu.edu/assets/docs/asbestos/2022-asbestos-contractors.pdf>.

ARTICLE 7

POST-BID INFORMATION

7.1 SUBMISSIONS

7.1.1 Unless waived by the Architect, the apparent low Bidder shall, within 24 hours after receipt of bids, submit the following information to the Architect:

7.1.1.1 A designation of the Work to be performed by the Bidder with their own forces.

7.1.1.2 The proprietary names and the suppliers of principal items or systems of material and equipment proposed for the Work.

7.1.1.3 A list of names of the Subcontractors or other persons or organizations (including those who are to furnish materials or equipment fabricated to a special design) proposed for each division and/or major subdivision, for the Owner's approval.

7.1.1.4 The names of the MBE/WBE and a description of work to be done by each, dollar value of Work and percentage of Contract price.

7.1.1.5 List of representatives authorized to perform Unifier functions on behalf of the contractor using the Unifier New Company Request, available at [Unifier System Vendor Information Form](#).

7.1.1.6 Certificate of Insurance demonstrating compliance with project requirements.

7.1.2 At the option of the Owner, the Bidder may be required to establish to the satisfaction of the Architect and the Owner the capability, reliability, and responsibility of the proposed Contractor and Subcontractors to furnish and perform the Work.

- 7.1.3 Subcontractors and other persons and organizations proposed by the Bidder and accepted by the Owner and the Architect must be used on the Work for which they were proposed and accepted and shall not be changed except with the written approval of the Owner and the Architect.

ARTICLE 8

PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

8.1 OWNER'S RIGHT TO REQUIRE BONDS

- 8.1.1 Each Bidder under a proposal in which the base bid exceeds \$50,000, shall include the premiums for furnishing a Performance Bond and also Labor Material Bond, each in the full amount of the proposal sum as specified in the Owner / Constructor Agreement.
- 8.1.2 The bonding firm must be listed on the current U.S. Department of Treasury Circular 570, rated A- or better by Best, and be licensed to do business in the State of Michigan. The bonds are to be made out to "Michigan State University, Board of Trustees."
- 8.1.3 In assuming assigned Subcontractor by the successful Bidder for general building work as specified, each assigned Subcontractor for each Subcontract shall reimburse the General Contractor his/her proportionate share of the premiums for bonds.

8.2 TIME OF DELIVERY AND FORM OF BONDS AND INSURANCE

- 8.2.1 The Bidder shall deliver two (2) copies of the required bonds and insurance to the Owner not later than the date of execution of the Contract.
- 8.2.2 The Bidder shall require the Attorney-In-Fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his/her Power of Attorney.

ARTICLE 9

FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

9.1 FORM TO BE USED

- 9.1.1 The Agreement for the Work will be governed by the project manual, and by the terms and conditions of ConsensusDocs 200- Standard Agreement and General Conditions Between Owner and Constructor (as modified by MSU).
- 9.1.2 If the project is under \$250,000, an MSU Purchase Order will be used and the terms and conditions of ConsensusDocs 200- Standard Agreement and General Conditions Between Owner and Constructor (as modified by MSU), will serve as the applicable General Conditions for administration of the Work.

- 9.1.3 If the project is over \$250,000, the ConsensusDocs 200- Standard Agreement and General Conditions Between Owner and Constructor will be used and the terms and conditions of that Agreement will be formalized through the execution of a Contract Finalization Form.

ARTICLE 10

APPLICATION FOR PAYMENT

10.1 FORM TO BE USED

- 10.1.1 Applications for Payment shall be submitted in Unifier in accordance with the Pay Apps (Pay Applications) business process. Refer to the MSU IPF website for more information

ARTICLE 11

ELECTRONIC TRANSACTIONS

11.1 UNIFIER

- 11.1.1 The Owner reserves the right to require that any or all transactions and submissions be conducted and delivered electronically through [Unifier](#), a web-based project management software system. Unifier functions on most popular web browsers. If the owner requires the use of Unifier, the owner will provide the necessary licenses for access into Unifier and the initial training necessary to use Unifier. Access to Unifier will be password restricted, and any proposal, acceptance, quote or other information submitted through Unifier through the use of a party's password shall be deemed to be the submission of such party and any proposal, acceptance, quote or other information in the submission shall be binding on such party as if such proposal, acceptance, quote or other information was in a writing signed by such party. Owner shall not be required to verify the validity of any such submission or inquire as to the authority of the user gaining access to Unifier through the use of a party's password. The following are the minimum Unifier user software and hardware requirements. It is the responsibility of the vendor to verify compatibility of their systems with Unifier. For more information, see [Unifier System Vendor Information Form](#).

11.2 CONTRACT EXECUTION

- 11.2.1 The Owner may choose to accept a scanned signed contract, provided through Unifier, as acceptance of the agreement. The Owner will rely on this document as properly signed by the Constructor.



ASBESTOS SURVEY REPORT

OWEN HALL

188BS23003

735 E Shaw Ln.
East Lansing, MI 48825

PREPARED FOR:

Michigan State University

PREPARED BY:

Atlas Technical Consultants LLC
46555 Humboldt Drive, Ste. 100
Novi, MI 48377

February 9, 2023



46555 Humboldt Dr., Ste. 100
Novi, MI 48377
(248) 669-5140 | oneatlas.com

February 8, 2023

MR. GARY BOSH
MICHIGAN STATE UNIVERSITY
4000 COLLINS Rd., B-20
LANSING, MI 48910

Subject: Asbestos Survey Report
Owen Hall
735 E Shaw Ln.
East Lansing, MI 48825

Dear Mr. Bosh:

Atlas Technical Consultants (Atlas) is pleased to submit the enclosed Asbestos Survey Report for the above-referenced location. The survey was conducted January 4, 2023 and January 30, 2023 in general accordance with Michigan State University's standard operating procedure.

Please refer to the attached Report, Tables, Drawings, and Analytical results for additional information.

If you have questions or desire additional information, please contact Atlas at 248-669-5140. Please refer to Atlas Project No. 188BS23003.

Respectfully submitted,

Atlas Technical Consultants LLC

A handwritten signature in black ink that reads "Andrew DeLodder".

Andrew DeLodder
Asbestos Inspector
Atlas Technical Consultants LLC

A handwritten signature in black ink that reads "Ryan Rae".

Ryan Rae
Project Manager
Atlas Technical Consultants LLC



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EXECUTIVE SUMMARY

Atlas performed a, asbestos survey of building materials at Michigan State University (MSU) Owen Hall at 735 E Shaw Ln., East Lansing, Michigan 48825. The asbestos survey included all accessible areas of the 1st floor west wing and was performed January 2nd-4th, 30th, 2023.

The survey was performed in general accordance with Federal, State and local rules for conducting asbestos surveys to meet Occupational Safety and Health Administration (OSHA) Asbestos for General Industry Standard (29 CFR 1910.1001(j)(2)(i)) and United States Environmental Protection Agency (EPA) / National Emission Standards for Hazardous Air Pollutants (NESHAP, 40 CFR Part 61) requirements.

In summary, the analytical results indicated asbestos was detected in twelve (12) of the one hundred and three (103) suspect materials collected and analyzed during the survey. The following suspect materials identified in Owen Hall were sampled and analyzed for asbestos content and were found to contain asbestos:

- Pipe Fittings- Canvas Wrapped, Mudded Fittings
- Interior Caulk- Beige, Around Perimeter Of The Sink
- Construction Adhesive- Dark Beige, Around Shower Door Perimeter
- Hanger Mud - White Mud Around Pipe Insulation At Hanging Hardware

The following materials are considered assumed to contain asbestos:

- Fire Door- Wood
- Fire Door- Metal
- Floor tile - 9" Black Tile With White Streaks With Mastic*
- Brick Mortar, Red Brick
- Ceramic Tile, Grout, & Mortar- 1" Brown Floor Tile
- Ceramic Tile, Grout, & Mortar- 4" Peach Wall Tile
- Mastic- Dark Gray, On West Wall
- Spray Applied Fire Proofing*

*Based on historic sampling these materials were found to be asbestos containing.

The following materials when tested were found not to contain asbestos:

- Plaster - On Wallboard And Metal Mesh At Corners**
- Concrete Chip - Poured Concrete Pad Foundation
- Floor Tile - 9" Black Tile With White Streaks
- Carpet Mastic - Yellow Mastic Under Blue Carpet With Multi-Colored Specks
- Cove Base - 4" Composite With Adhesive
- Wall Sheeting - Canvas Wall Covering With Crisscross Troweled Texture
- Interior Caulk - Red, In Wall/Ceiling Penetrations And Voids.
- Ceiling Tile - 12" White Pinhole And Fissure
- Glue Pods - Light Grey Glue Adhering Ceiling Tiles T Concrete Deck

- Glue Pods - Light Brown, Remnants Of Previous Glue Pods That Were Replaced By The Light Grey Glue Pods
- Brick Mortar - CMU Block
- Pipe Insulation - Paper Wrapped Yellow Fiberglass
- Interior Caulk - Grey, Around Sliding Door Frame
- Ceiling Tile - 12" White With A Rough Textured Pinhole And Fissure Pattern
- Carpet Mastic - Yellow Mastic Under Green, Blue, Red, And Beige Wave Pattern Carpet
- Textured Plaster; Swirl/Bumpy Texture**
- Cove Base - 4" Black With Adhesive
- Ceramic Tile, Grout, Mortar - 2" Blue And Green Floor Tile
- Ceramic Tile, Grout, Mortar - 4" Beige Wall Tile
- Interior Caulk - Around Shower Perimeter
- Heat Shield - Black, In Shower Light Fixture
- Gasket Material - Paper, Between Mirror Glass And Metal Trim
- Corrugated Paper - Between Mirror Panel And Metal Panel
- Window Glaze- Gray
- Carpet Mastic - Beige Mastic Under Pink Carpet
- Carpet Mastic - Under Striped Carpet Squares, Earthy Colors
- Cove Base - Dark Grey, With Multiple Layers Of Adhesive
- Mastic - Black Mastic From Former Floor Tile, Under Carpet
- Window Glaze- White
- Carpet Mastic - Beige Mastic Under Green, Beige, And Black Speckled Carpet
- Floor Tile- 20" Green Tile**
- Stair Tread, Green**

**Based on historical sampling these materials were found to be non-asbestos containing.

1.1 General Observations

The following suspect materials were observed and are assumed to contain asbestos but were not sampled because they were either inaccessible, they were located in areas excluded from the project scope of work, non-destructive sampling could not be performed or they were sampled during a previous sampling event and were found to contain asbestos:

- Fire Door- Wood
- Fire Door- Metal
- Floor tile - 9" Black Tile With White Streaks With Mastic*
- Brick Mortar, Red Brick
- Ceramic Tile, Grout, & Mortar- 1" Brown Floor Tile
- Ceramic Tile, Grout, & Mortar- 4" Peach Wall Tile
- Mastic- Dark Gray, On West Wall
- Spray Applied Fire Proofing*

*Based on historic sampling these materials were found to be asbestos containing



A complete list of suspect materials identified in Owen Hall which were sampled and analyzed for asbestos content and were not found to contain asbestos are included in Appendix I (Homogenous Area List).

Several construction and finish materials were observed in the site building that were determined to be non-suspect materials. These materials included:

- Clay/terra-cotta Structural Block
- Wood
- Carpet
- Wallpaper
- Glass

1.2 Discussion and Recommendations

The results of the asbestos survey conducted January 2-4, 2023 and January 30, 2023, at Owen Hall, indicated that twelve (12) of the one hundred and three (103) suspect materials sampled by Atlas were found to be asbestos-containing materials (ACMs) as defined by the EPA and State of Michigan Occupational Safety and Health Administration (MIOSHA) regulations.

It should be further noted that additional suspect ACMs, beyond those identified during this survey, may be present in inaccessible areas and / or spaces concealed by practical and / or manual means of retrieval. These areas and / or spaces include, but are not limited to, buried piping, obstructed wall/ceiling/floor cavities, interstitial spaces, concrete or mortar-entombed materials, mechanical pipe gaskets and packings, insulated electrical components, etc. Atlas recommends any suspect ACMs not previously sampled, that are discovered during renovations be sampled to determine asbestos content and addressed accordingly.

2. ASBESTOS SURVEY

2.1 Introduction

The survey was performed in accordance with Federal, State and local rules for conducting asbestos surveys to meet Occupational Safety and Health Administration (OSHA) Asbestos for General Industry Standard (29 CFR 1910.1001(j)(2)(i)) and United States Environmental Protection Agency (EPA) / National Emission Standards for Hazardous Air Pollutants (NESHAP, 40 CFR Part 61) requirements.

Atlas collected one hundred and three (103) bulk samples comprising one hundred and twenty (120) layers and forty-five (44) suspect materials from various areas throughout the interior and exterior of the site building. These samples were packaged and delivered to Environmental Testing Laboratory (ETL) located in Romulus, Michigan and were submitted for Polarized Light Microscopy (PLM) analyses.

2.2 Site & Building Descriptions

Owen Hall is located at 735 E Shaw Ln. in East Lansing, Michigan 48825, and is an active campus facility. Owen Hall consists primarily of masonry and steel frame construction. Owen Hall primarily



consists of class rooms, staff offices, conference rooms, lobby commons, and common bathrooms as well as mechanical and maintenance areas. Interior finishes include a variety of materials including, but not limited to: suspended tile, plaster walls and ceilings, drywall; and concrete floors with predominantly carpet, vinyl/asphalt tile, or ceramic tile finishes.

2.3 Summary of Findings

Bulk samples were collected of suspect asbestos-containing materials (ACMs) and grouped by homogeneous area (HA). An HA is characterized as surfacing material, thermal system insulation (TSI), or miscellaneous material that is uniform in use, colors, appearance, pattern, texture, and date of installation. The HA can be described within a single building (i.e., red floor tile in different buildings on the same complex, even if installed on the same day, compose different HAs).

Bulk samples were obtained with tools designed to penetrate a material without creating excessive dust. An effort was made to obtain samples that were representative of all layers of the material. The areas were pre-wetted to reduce potential dust generation during the sampling process.

Atlas's sampling procedures incorporate the use of sealable containers labeled in a unique numbering sequence to store bulk samples. Information about bulk samples, including the sample numbers and materials' descriptions, were noted on the chain-of-custody sheets after samples were collected. Laboratory analytical results and field chain-of-custody sheets are included in Appendix III.

The site was inspected for the presence of material that may contain more than one-percent asbestos (ACMs), as per the State of Michigan Occupational Safety and Health Administration (MIOSHA) regulations. In accordance with the scope of work for the project the survey included the interior of the west wing of the building and was conducted using non-destructive sampling procedures. Site diagrams of the building areas with labeled functional space designations and bulk sample locations are included in Appendix II.

Samples were analyzed using PLM, utilizing dispersion staining techniques (EPA Method 600/R-93/116, July-1993) to assess the percentage of asbestos present on the basis of visual area estimation. ACMs are defined as materials that contain greater than 1% asbestos.

The analytical results indicated asbestos was detected in twelve (12) of forty-five (45) suspect materials comprising one hundred and three (103) bulk samples (120 layers) collected and analyzed during this portion of the survey

2.4 Quality Control

The bulk samples collected by Atlas were submitted for PLM analysis to Environmental Testing Laboratory, Inc. (ETL), located in Romulus, Michigan. ETL performs bulk PLM analysis conforming with EPA-prescribed methodologies, operates in accordance with a written Standard Operating Procedure and maintains compliance with a formal Quality Assurance (QA) Program. This program follows quality guidelines as documented in third-party accreditation



authorities including the NIST National Voluntary Laboratory Accreditation Program (NVLAP). Apex is accredited by NVLAP (Lab Code 201028-0). Apex's internal Quality Control (QC) program includes 10% quality control on all samples received for analysis, proficiency testing and round-robin protocols. A copy of ETL's NVLAP-accreditation certificate is included in Attachment D.

Atlas's inspectors maintain their Asbestos Building Inspector accreditation in compliance with the EPA requirements under 40 CFR 763 and Michigan Compiled Laws (MCL) 338.3403, Sec.3(1)(a) of the Michigan Asbestos Workers Accreditation Act (Act 440, P.A. 1988, as amended). Under authority of Michigan's Department of Licensing and Regulatory Affairs (LARA), MIOASHA's Asbestos Program administers asbestos accreditations. Copies of Atlas's inspectors' Asbestos Building Inspector accreditations are included in Attachment D.

2.5 Observations

The following suspect materials identified in the Owen Hall building were sampled and analyzed for asbestos content and were found to contain asbestos:

- Pipe Fittings- Canvas Wrapped, Mudded Fittings
- Interior Caulk- Beige, Around Perimeter Of The Sink
- Construction Adhesive- Dark Beige, Around Shower Door Perimeter
- Hanger Mud - White Mud Around Pipe Insulation At Hanging Hardware

The following materials are considered assumed to contain asbestos:

- Fire Door- Wood
- Fire Door- Metal
- Floor tile - 9" Black Tile With White Streaks With Mastic*
- Brick Mortar, Red Brick
- Ceramic Tile, Grout, & Mortar- 1" Brown Floor Tile
- Ceramic Tile, Grout, & Mortar- 4" Peach Wall Tile
- Mastic- Dark Gray, On West Wall
- Spray Applied Fire Proofing*

*Based on historic sampling these materials were found to be asbestos containing.

The following materials when tested were found not to contain asbestos:

- Plaster - On Wallboard And Metal Mesh At Corners**
- Concrete Chip - Poured Concrete Pad Foundation
- Floor Tile - 9" Black Tile With White Streaks
- Carpet Mastic - Yellow Mastic Under Blue Carpet With Multi-Colored Specks
- Cove Base - 4" Composite With Adhesive
- Wall Sheeting - Canvas Wall Covering With Crisscross Troweled Texture
- Interior Caulk - Red, In Wall/Ceiling Penetrations And Voids.

- Ceiling Tile - 12" White Pinhole And Fissure
- Glue Pods - Light Grey Glue Adhering Ceiling Tiles T Concrete Deck
- Glue Pods - Light Brown, Remnants Of Previous Glue Pods That Were Replaced By The Light Grey Glue Pods
- Brick Mortar - CMU Block
- Pipe Insulation - Paper Wrapped Yellow Fiberglass
- Interior Caulk - Grey, Around Sliding Door Frame
- Ceiling Tile - 12" White With A Rough Textured Pinhole And Fissure Pattern
- Carpet Mastic - Yellow Mastic Under Green, Blue, Red, And Beige Wave Pattern Carpet
- Textured Plaster; Swirl/Bumpy Texture**
- Cove Base - 4" Black With Adhesive
- Ceramic Tile, Grout, Mortar - 2" Blue And Green Floor Tile
- Ceramic Tile, Grout, Mortar - 4" Beige Wall Tile
- Interior Caulk - Around Shower Perimeter
- Heat Shield - Black, In Shower Light Fixture
- Gasket Material - Paper, Between Mirror Glass And Metal Trim
- Corrugated Paper - Between Mirror Panel And Metal Panel
- Window Glaze- Gray
- Carpet Mastic - Beige Mastic Under Pink Carpet
- Carpet Mastic - Under Striped Carpet Squares, Earthy Colors
- Cove Base - Dark Grey, With Multiple Layers Of Adhesive
- Mastic - Black Mastic From Former Floor Tile, Under Carpet
- Window Glaze- White
- Carpet Mastic - Beige Mastic Under Green, Beige, And Black Speckled Carpet
- Floor Tile- 20" Green Tile**
- Stair Tread, Green**

**Based on historical sampling these materials were found to be non-asbestos containing.

The following suspect materials were observed and are assumed to contain asbestos but were not sampled because they were either inaccessible, they were located in areas excluded from the project scope of work, non-destructive sampling could not be performed or they were sampled during a previous sampling event and were found to contain asbestos:

- Fire Door- Wood
- Fire Door- Metal
- Floor tile - 9" Black Tile With White Streaks With Mastic*
- Brick Mortar, Red Brick
- Ceramic Tile, Grout, & Mortar- 1" Brown Floor Tile
- Ceramic Tile, Grout, & Mortar- 4" Peach Wall Tile
- Mastic- Dark Gray, On West Wall
- Spray Applied Fire Proofing*

*Based on historic sampling these materials were found to be asbestos containing
Several construction and finish materials were observed in the site building that were determined to be non-suspect materials. These materials included:

- Clay/terra-cotta Structural Block
- Wood



- Carpet
- Wallpaper
- Glass

A complete list of suspect materials identified in Owen Hall which were sampled and analyzed for asbestos content and were not found to contain asbestos are included in Appendix I (Homogenous Area List)

2.6 Discussion and Recommendations

The results of the asbestos survey conducted on January 2-4, 2023 and January 30, 2023, in the Owen Hall building in East Lansing, Michigan 48825, indicated that of the materials sampled by Atlas several were found to be ACMs (>1%) as defined by the EPA and MIOSHA regulations. Data tables with corresponding bulk sampling information are included in Appendix I.

It should be noted, based on project scope of work limitations, exterior roof sampling was not performed. However, visual observations of the exterior roofing system indicate suspect materials are present. Therefore, inspection and sampling of the roof may be necessary for regulatory compliance prior to future roof renovations, replacement, or demolition.

It should be further noted that additional suspect ACMs, beyond those identified during this survey, may be present in inaccessible areas and / or spaces concealed by practical and / or manual means of retrieval. These areas and / or spaces include, but are not limited to, buried piping, obstructed wall/ceiling/floor cavities, interstitial spaces, concrete or mortar-entombed materials, mechanical pipe gaskets and packings, insulated electrical components, etc. ATC recommends any suspect ACMs not previously sampled, that are discovered during renovations be sampled to determine asbestos content and addressed accordingly.

This report is designed to aid the building owner, architect, construction manager, general contractors, and potential asbestos abatement contractors in locating ACM. Under no circumstances is the report to be utilized as a bidding document or as a project specification document.

APPENDIX I TABLES

LIST BY FUNCTIONAL SPACE

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|-----|-------------------|--|-----|--------|-------|----------|
| 1 | 1HW1 - corridor | Fire door - wood door | 1 | 34 | doors | A |
| 1 | 1HW1 - corridor | Fire door - metal door | 2 | 5 | doors | A |
| 1 | 1HW1 - corridor | Concrete chip - poured concrete pad foundation | 3 | 1,165 | SF | N |
| 1 | 1HW1 - corridor | Floor tile - 9" black tile with white streaks, and mastic | 4 | 1,165 | SF | N |
| 1 | 1HW1 - corridor | Carpet mastic - yellow mastic under blue carpet with multi-colored specks | 5 | 1,165 | SF | N |
| 1 | 1HW1 - corridor | Cove base - 4" composite with adhesive | 6 | 385 | LF | N |
| 1 | 1HW1 - corridor | Wall sheeting - canvas wall covering with criss-cross trowelled texture | 7 | 3,176 | SF | N |
| 1 | 1HW1 - corridor | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 5 | SF | N |
| 1 | 1HW1 - corridor | Ceiling tile - 12" white pinhole and fissure | 9 | 1,165 | SF | N |
| 1 | 1HW1 - corridor | Glue pods - light grey glue adhering ceiling tiles t concrete deck | 10 | 1,165 | SF | N |
| 1 | 1HW1 - corridor | replaced by the light grey glue pods | 11 | 1,165 | SF | N |
| 2 | W114 - trunk room | Concrete chip - poured concrete pad foundation | 3 | 210 | SF | N |
| 2 | W114 - trunk room | Brick mortar - CMU block | 12 | 520 | SF | N |
| 2 | W114 - trunk room | Pipe insulation - paper wrapped yellow fiberglass | 13 | 20 | LF | N |
| 2 | W114 - trunk room | Pipe insulation - canvas wrapped beige fiberglass | 14 | 25 | LF | N |
| 2 | W114 - trunk room | Pipe fitting - canvas wrapped mudded fitting | 16 | 8 | Ea | N |
| 3 | W115 - lounge | Fire door - wood door | 1 | 1 | doors | A |
| 3 | W115 - lounge | Concrete chip - poured concrete pad foundation | 3 | 320 | SF | N |
| 3 | W115 - lounge | Floor tile - 9" black tile with white streaks, and mastic | 4 | 320 | SF | N |
| 3 | W115 - lounge | Cove base - 4" burgundy composite with adhesive | 6 | 80 | LF | N |
| 3 | W115 - lounge | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 3 | W115 - lounge | remaining as the original ceiling tile was removed and replaced by the | 11 | 320 | SF | N |
| 3 | W115 - lounge | Plaster - on wallboard and metal mesh at corners | 12 | 840 | SF | N |
| 3 | W115 - lounge | Interior caulk - grey, around sliding door frame | 17 | 20 | LF | N |
| 3 | W115 - lounge | Ceiling tile - 12" white with a rough textured pinhole and fissure pattern | 18 | 320 | SF | N |
| 4 | W116 - office | Fire door - wood door | 1 | 1 | door | A |
| 4 | W116 - office | Concrete chip - poured concrete pad foundation | 3 | 270 | SF | N |
| 4 | W116 - office | Floor tile - 9" black tile with white streaks, and mastic | 4 | 270 | SF | N |
| 4 | W116 - office | Cove base - 4" burgundy composite with adhesive | 6 | 95 | LF | N |
| 4 | W116 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 4 | W116 - office | Plaster - on wallboard and metal mesh at corners | 12 | 1,180 | SF | N |
| 4 | W116 - office | pattern carpet | 19 | 270 | SF | N |
| 4 | W116 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 1,180 | SF | N |
| 4 | W116 - office | Cove base - 4" black with adhesive | 21 | 5 | LF | N |
| 4 | W116 - office | Window glaze, black | 29 | 4 | Ea | N |
| 5 | W116A - bathroom | Fire door - wood door | 1 | 2 | doors | A |

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|----------|-------------------------|--|-----------|------------|--------------|----------|
| 5 | W116A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 5 | W116A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 5 | W116A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 5 | W116A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 5 | W116A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 5 | W116A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 5 | W116A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 5 | W116A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 5 | W116A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |
| 5 | W116A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 5 | W116A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 5 | W116A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 5 | W116A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 6 | W117 - office | Concrete chip - poured concrete pad foundation | 3 | 135 | SF | N |
| 6 | W117 - office | Floor tile - 9" black tile with white streaks, and mastic, and mastic | 4 | 135 | SF | A |
| 6 | W117 - office | Cove base - 4" burgundy composite with adhesive | 6 | 50 | LF | N |
| 6 | W117 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 6 | W117 - office | Plaster - on wallboard and metal mesh at corners | 12 | 590 | SF | N |
| 6 | W117 - office | pattern carpet | 19 | 135 | SF | N |
| 6 | W117 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 590 | SF | N |
| 6 | W117 - office | Cove base - 4" black with adhesive | 21 | 5 | LF | N |
| 6 | W117 - office | Window glaze, black | 29 | 2 | Ea | N |
| 6 | W116A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 7 | W118A - bathroom | Fire door - wood door | 1 | 2 | doors | A |
| 7 | W118A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 7 | W118A - bathroom | Cove base - 4" burgundy composite with adhesive | 6 | 20 | LF | N |
| 7 | W118A - bathroom | Wall sheeting - canvas wall covering with criss-cross trowelled texture | 7 | 304 | SF | N |
| 7 | W118A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 7 | W118A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | SF | N |
| 7 | W118A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 7 | W118A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 7 | W118A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 7 | W118A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 7 | W118A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |
| 7 | W118A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 7 | W118A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|-----|-------------------------|--|-----------|------------|--------------|----------|
| 7 | W118A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 7 | W118A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 7 | W118A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 8 | W118 - office | Concrete chip - poured concrete pad foundation | 3 | 700 | SF | N |
| 8 | W118 - office | Floor tile - 9" black tile with white streaks, and mastic, and mastic | 4 | 700 | SF | A |
| 8 | W118 - office | Cove base - 4" burgundy composite with adhesive | 6 | 185 | LF | N |
| 8 | W118 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 2 | SF | N |
| 8 | W118 - office | Plaster - on wallboard and metal mesh at corners | 12 | 2,140 | SF | N |
| 8 | W118 - office | pattern carpet | 19 | 700 | SF | N |
| 8 | W118 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 2,140 | SF | N |
| 8 | W118 - office | Cove base - 4" black with adhesive | 21 | 15 | LF | N |
| 8 | W118 - office | Window glaze - black | 29 | 8 | Ea | N |
| 9 | W120A - bathroom | Fire door - wood door | 1 | 2 | doors | A |
| 9 | W120A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 9 | W120A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 9 | W120A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 9 | W120A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 9 | W120A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 9 | W120A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 9 | W120A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 9 | W120A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 9 | W120A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |
| 9 | W120A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 9 | W120A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 9 | W120A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 9 | W120A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 9 | W120A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 10 | W122A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 10 | W122A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 10 | W122A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 10 | W122A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 10 | W122A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 10 | W122A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 10 | W122A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 10 | W122A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 10 | W122A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|-----------|-------------------------|--|-----------|------------|--------------|----------|
| 10 | W122A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 10 | W122A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 10 | W122A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 10 | W122A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 10 | W122A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 11 | W122 - office | Fire door - wood door | 1 | 1 | door | A |
| 11 | W122 - office | Concrete chip - poured concrete pad foundation | 3 | 135 | SF | N |
| 11 | W122 - office | Floor tile - 9" black tile with white streaks, and mastic, and mastic | 4 | 135 | SF | A |
| 11 | W122 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 11 | W122 - office | Plaster - on wallboard and metal mesh at corners | 12 | 590 | SF | N |
| 11 | W122 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 590 | SF | N |
| 11 | W122 - office | Cove base - 4" black with adhesive | 21 | 70 | LF | N |
| 11 | W122 - office | Window glaze - black | 29 | 2 | Ea | N |
| 11 | W122 - office | Carpet mastic - beige mastic under pink carpet | 31 | 135 | SF | N |
| 12 | W123 - office | Concrete chip - poured concrete pad foundation | 3 | 135 | SF | N |
| 12 | W123 - office | Floor tile - 9" black tile with white streaks, and mastic, and mastic | 4 | 135 | SF | A |
| 12 | W123 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 12 | W123 - office | Plaster - on wallboard and metal mesh at corners | 12 | 590 | SF | N |
| 12 | W123 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 590 | SF | N |
| 12 | W123 - office | Cove base - 4" black with adhesive | 21 | 70 | LF | N |
| 12 | W123 - office | Window glaze - black | 29 | 2 | Ea | N |
| 12 | W123 - office | Carpet mastic - beige mastic under pink carpet | 31 | 135 | SF | N |
| 13 | W124A - bathroom | Fire door - wood door | 1 | 2 | doors | A |
| 13 | W124A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 13 | W124A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 13 | W124A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 13 | W124A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 13 | W124A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 13 | W124A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 13 | W124A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 13 | W124A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 13 | W124A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |
| 13 | W124A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 13 | W124A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 13 | W124A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 13 | W124A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|-----------|-------------------------|--|-----------|------------|--------------|----------|
| 14 | W124 - office | Concrete chip - poured concrete pad foundation | 3 | 135 | SF | N |
| 14 | W124 - office | Floor tile - 9" black tile with white streaks, and mastic, and mastic | 4 | 135 | SF | A |
| 14 | W124 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 14 | W124 - office | Plaster - on wallboard and metal mesh at corners | 12 | 590 | SF | N |
| 14 | W124 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 590 | SF | N |
| 14 | W124 - office | Cove base - 4" black with adhesive | 21 | 80 | LF | N |
| 14 | W124 - office | Window glaze - black | 29 | 2 | Ea | N |
| 15 | W125 - office | Concrete chip - poured concrete pad foundation | 3 | 135 | SF | N |
| 15 | W125 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 15 | W125 - office | Plaster - on wallboard and metal mesh at corners | 12 | 590 | SF | N |
| 15 | W125 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 590 | SF | N |
| 15 | W125 - office | Window glaze - black | 29 | 2 | Ea | N |
| 15 | W125 - office | Carpet mastic - under striped carpet squares, earthy colors | 32 | 135 | SF | N |
| 15 | W125 - office | Cove base - dark grey, with multiple layers of adhesive | 33 | 80 | LF | N |
| 16 | W126A - bathroom | Fire door - wood door | 1 | 2 | doors | A |
| 16 | W126A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 16 | W126A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 16 | W126A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 16 | W126A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 16 | W126A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 16 | W126A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 16 | W126A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 16 | W126A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 16 | W126A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |
| 16 | W126A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 16 | W126A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 16 | W126A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 16 | W126A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 16 | W126A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 17 | W126 - office | Concrete chip - poured concrete pad foundation | 3 | 135 | SF | N |
| 17 | W126 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 17 | W126 - office | Plaster - on wallboard and metal mesh at corners | 12 | 590 | SF | N |
| 17 | W126 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 590 | SF | N |
| 17 | W126 - office | Window glaze - black | 29 | 2 | Ea | N |
| 17 | W126 - office | Carpet mastic - under striped carpet squares, earthy colors | 32 | 135 | SF | N |
| 17 | W126 - office | Cove base - dark grey, with multiple layers of adhesive | 33 | 80 | LF | N |

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|-----------|-------------------------|---|-----------|------------|--------------|----------|
| 18 | W127 - office | Concrete chip - poured concrete pad foundation | 3 | 135 | SF | N |
| 18 | W127 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 18 | W127 - office | Plaster - on wallboard and metal mesh at corners | 12 | 590 | SF | N |
| 18 | W127 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 590 | SF | N |
| 18 | W127 - office | Window glaze - black | 29 | 2 | Ea | N |
| 18 | W127 - office | Carpet mastic - under striped carpet squares, earthy colors | 32 | 135 | SF | N |
| 18 | W127 - office | Cove base - dark grey, with multiple layers of adhesive | 33 | 80 | LF | N |
| 19 | W128A - bathroom | Fire door - wood door | 1 | 2 | doors | A |
| 19 | W128A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 19 | W128A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 19 | W128A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 19 | W128A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 19 | W128A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 19 | W128A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 19 | W128A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 19 | W128A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 19 | W128A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |
| 19 | W128A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 19 | W128A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 19 | W128A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 19 | W128A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 19 | W128A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 20 | W128 - office | Fire door - wood door | 1 | 1 | door | A |
| 20 | W128 - office | Concrete chip - poured concrete pad foundation | 3 | 440 | SF | N |
| 20 | W128 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 20 | W128 - office | Plaster - on wallboard and metal mesh at corners | 12 | 2,025 | SF | N |
| 20 | W128 - office | Window glaze - black | 29 | 5 | Ea | N |
| 20 | W128 - office | Carpet mastic - under striped carpet squares, earthy colors | 32 | 440 | SF | N |
| 20 | W128 - office | Cove base - dark grey, with multiple layers of adhesive | 33 | 115 | LF | N |
| 20 | W128 - office | Mastic - black mastic from former floor tile, under carpet | 34 | 440 | SF | N |
| 21 | W130A - bathroom | Fire door - wood door | 1 | 2 | doors | A |
| 21 | W130A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 21 | W130A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 21 | W130A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 21 | W130A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 21 | W130A - bathroom | pattern carpet | 19 | 70 | SF | N |

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|-----|----------------------------|--|-----------|------------|-------------|----------|
| 21 | W130A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 21 | W130A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 21 | W130A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 21 | W130A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |
| 21 | W130A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 21 | W130A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 21 | W130A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 21 | W130A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 21 | W130A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 22 | W130 - office | Concrete chip - poured concrete pad foundation | 3 | 180 | SF | N |
| 22 | W130 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 22 | W130 - office | Plaster - on wallboard and metal mesh at corners | 12 | 700 | SF | N |
| 22 | W130 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 700 | SF | N |
| 22 | W130 - office | Window glaze - black | 29 | 3 | Ea | N |
| 22 | W130 - office | Carpet mastic - under striped carpet squares, earthy colors | 32 | 180 | SF | N |
| 22 | W130 - office | Cove base - dark grey, with multiple layers of adhesive | 33 | 80 | LF | N |
| 22 | W130 - office | Mastic - black mastic from former floor tile, under carpet | 34 | 180 | SF | N |
| 23 | W2 - stairs | Concrete chip - poured concrete pad foundation | 3 | 200 | SF | N |
| 23 | W2 - stairs | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 23 | W2 - stairs | Cove base - 4" black with adhesive | 21 | 80 | LF | N |
| 23 | W2 - stairs | Floor tile - 20" green tile | 35 | 100 | SF | N |
| 23 | W2 - stairs | Stair tread - green tread | 36 | 100 | SF | N |
| 23 | W2 - stairs | Brick mortar - red brick | 37 | 400 | SF | A |
| 23 | W2 - stairs | Window glaze - white | 38 | 9 | Ea | N |
| 24 | W130B - maintenance | Fire door - wood door | 1 | 1 | door | A |
| 24 | W130B - maintenance | Concrete chip - poured concrete pad foundation | 3 | 220 | SF | N |
| 24 | W130B - maintenance | Floor tile - 9" black tile with white streaks, and mastic, and mastic | 4 | 120 | SF | A |
| 24 | W130B - maintenance | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 24 | W130B - maintenance | Brick mortar - CMU block | 13 | 650 | SF | N |
| 24 | W130B - maintenance | Pipe insulation - canvas wrapped beige fiberglass | 15 | 20 | LF | N |
| 24 | W130B - maintenance | Pipe fitting - canvas wrapped mudded fitting | 16 | 6 | Ea | Y |
| 24 | W130B - maintenance | Cove base - 4" black with adhesive | 21 | 40 | LF | N |
| 24 | W130B - maintenance | Ceramic tile, grout, mortar - 1" brown floor tile | 39 | 100 | SF | A |
| 24 | W130B - maintenance | Ceramic tile, grout, mortar - 4" peach wall tile | 40 | 15 | SF | A |
| 24 | W130B | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 25 | W131 - office | Concrete chip - poured concrete pad foundation | 3 | 500 | SF | N |

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|-----|------------------|--|-----|--------|-------|----------|
| 25 | W131 - office | Floor tile - 9" black tile with white streaks, and mastic, and mastic | 4 | 500 | SF | A |
| 25 | W131 - office | Carpet mastic - yellow mastic under blue carpet with multi-colored specks | 5 | 500 | SF | N |
| 25 | W131 - office | Wall sheeting - canvas wall covering with criss-cross trowelled texture | 7 | 400 | SF | N |
| 25 | W131 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 25 | W131 - office | Plaster - on wallboard and metal mesh at corners | 12 | 1,580 | SF | N |
| 25 | W131 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 1,580 | SF | N |
| 25 | W131 - office | Cove base - 4" black with adhesive | 21 | 180 | LF | N |
| 25 | W131 - office | Window glaze - black | 29 | 6 | Ea | N |
| 26 | W131A - bathroom | Fire door - wood door | 1 | 2 | doors | A |
| 26 | W131A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 26 | W131A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 26 | W131A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 26 | W131A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 26 | W131A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 26 | W131A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 26 | W131A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 26 | W131A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 26 | W131A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |
| 26 | W131A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 26 | W131A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 26 | W131A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 26 | W131A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 26 | W131A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 27 | W133 - office | Concrete chip - poured concrete pad foundation | 3 | 180 | SF | N |
| 27 | W133 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 27 | W133 - office | Plaster - on wallboard and metal mesh at corners | 12 | 700 | SF | N |
| 27 | W133 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 700 | SF | N |
| 27 | W133 - office | Window glaze - black | 29 | 2 | Ea | N |
| 27 | W133 - office | Carpet mastic - under striped carpet squares, earthy colors | 32 | 180 | SF | N |
| 27 | W133 - office | Cove base - dark grey, with multiple layers of adhesive | 33 | 80 | LF | N |
| 27 | W133 - office | Mastic - black mastic from former floor tile, under carpet | 34 | 180 | SF | N |
| 28 | W133A - bathroom | Fire door - wood door | 1 | 2 | doors | A |
| 28 | W133A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 28 | W133A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 28 | W133A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 28 | W133A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|-----------|-------------------------|---|-----------|------------|--------------|----------|
| 28 | W133A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 28 | W133A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 28 | W133A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 28 | W133A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 28 | W133A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |
| 28 | W133A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 28 | W133A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 28 | W133A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 28 | W133A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 28 | W133A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 29 | W134 - office | Concrete chip - poured concrete pad foundation | 3 | 180 | SF | N |
| 29 | W134 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 29 | W134 - office | Plaster - on wallboard and metal mesh at corners | 12 | 700 | SF | N |
| 29 | W134 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 700 | SF | N |
| 29 | W134 - office | Window glaze - black | 29 | 2 | Ea | N |
| 29 | W134 - office | Carpet mastic - under striped carpet squares, earthy colors | 32 | 180 | SF | N |
| 29 | W134 - office | Cove base - dark grey, with multiple layers of adhesive | 33 | 80 | LF | N |
| 29 | W134 - office | Mastic - black mastic from former floor tile, under carpet | 34 | 180 | SF | N |
| 30 | W135 - office | Concrete chip - poured concrete pad foundation | 3 | 180 | SF | N |
| 30 | W135 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 30 | W135 - office | Plaster - on wallboard and metal mesh at corners | 12 | 700 | SF | N |
| 30 | W135 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 700 | SF | N |
| 30 | W135 - office | Window glaze - black | 29 | 2 | Ea | N |
| 30 | W135 - office | Carpet mastic - under striped carpet squares, earthy colors | 32 | 180 | SF | N |
| 30 | W135 - office | Cove base - dark grey, with multiple layers of adhesive | 33 | 80 | LF | N |
| 30 | W135 - office | Mastic - black mastic from former floor tile, under carpet | 34 | 180 | SF | N |
| 31 | W135A - bathroom | Fire door - wood door | 1 | 2 | doors | A |
| 31 | W135A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 31 | W135A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 31 | W135A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 31 | W135A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 31 | W135A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 31 | W135A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 31 | W135A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 31 | W135A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 31 | W135A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|-----------|-------------------------|--|-----------|------------|--------------|----------|
| 31 | W135A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 31 | W135A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 31 | W135A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 31 | W135A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 31 | W135A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 32 | W136 - office | Concrete chip - poured concrete pad foundation | 3 | 180 | SF | N |
| 32 | W136 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 32 | W136 - office | Plaster - on wallboard and metal mesh at corners | 12 | 700 | SF | N |
| 32 | W136 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 700 | SF | N |
| 32 | W136 - office | Window glaze - black | 29 | 2 | Ea | N |
| 32 | W136 - office | Carpet mastic - under striped carpet squares, earthy colors | 32 | 180 | SF | N |
| 32 | W136 - office | Cove base - dark grey, with multiple layers of adhesive | 33 | 80 | LF | N |
| 32 | W136 - office | Mastic - black mastic from former floor tile, under carpet | 34 | 180 | SF | N |
| 33 | W137 - office | Concrete chip - poured concrete pad foundation | 3 | 180 | SF | N |
| 33 | W137 - office | Floor tile - 9" black tile with white streaks, and mastic, and mastic | 4 | 180 | SF | A |
| 33 | W137 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 33 | W137 - office | Plaster - on wallboard and metal mesh at corners | 12 | 700 | SF | N |
| 33 | W137 - office | pattern carpet | 19 | 180 | SF | N |
| 33 | W137 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 700 | SF | N |
| 33 | W137 - office | Cove base - 4" black with adhesive | 21 | 80 | LF | N |
| 33 | W137 - office | Window glaze - black | 29 | 2 | Ea | N |
| 34 | W137A - bathroom | Fire door - wood door | 1 | 2 | doors | A |
| 34 | W137A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 34 | W137A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 34 | W137A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 34 | W137A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 34 | W137A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 34 | W137A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 34 | W137A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 34 | W137A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 34 | W137A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |
| 34 | W137A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 34 | W137A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 34 | W137A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 34 | W137A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 34 | W137A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|-----------|-------------------------|--|-----------|------------|--------------|----------|
| 35 | W138 - office | Concrete chip - poured concrete pad foundation | 3 | 180 | SF | N |
| 35 | W138 - office | Floor tile - 9" black tile with white streaks, and mastic, and mastic | 4 | 180 | SF | A |
| 35 | W138 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 35 | W138 - office | Plaster - on wallboard and metal mesh at corners | 12 | 700 | SF | N |
| 35 | W138 - office | pattern carpet | 19 | 180 | SF | N |
| 35 | W138 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 700 | SF | N |
| 35 | W138 - office | Cove base - 4" black with adhesive | 21 | 80 | LF | N |
| 35 | W138 - office | Window glaze - black | 29 | 2 | Ea | N |
| 36 | W139 - office | Concrete chip - poured concrete pad foundation | 3 | 180 | SF | N |
| 36 | W139 - office | Floor tile - 9" black tile with white streaks, and mastic, and mastic | 4 | 180 | SF | A |
| 36 | W139 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 36 | W139 - office | Plaster - on wallboard and metal mesh at corners | 12 | 700 | SF | N |
| 36 | W139 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 700 | SF | N |
| 36 | W139 - office | Cove base - 4" black with adhesive | 21 | 80 | LF | N |
| 36 | W139 - office | Window glaze - black | 29 | 2 | Ea | N |
| 36 | W139 - office | Carpet mastic - beige mastic under pink carpet | 31 | 180 | SF | N |
| 37 | W139A - bathroom | Fire door - wood door | 1 | 2 | doors | A |
| 37 | W139A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 37 | W139A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 37 | W139A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 37 | W139A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 37 | W139A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 37 | W139A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 37 | W139A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 37 | W139A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 37 | W139A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |
| 37 | W139A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 37 | W139A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 37 | W139A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 37 | W139A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 37 | W139A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 38 | W140 - office | Concrete chip - poured concrete pad foundation | 3 | 180 | SF | N |
| 38 | W140 - office | Floor tile - 9" black tile with white streaks, and mastic, and mastic | 4 | 15 | SF | A |
| 38 | W140 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 38 | W140 - office | Plaster - on wallboard and metal mesh at corners | 12 | 700 | SF | N |
| 38 | W140 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 700 | SF | N |

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|-----------|-------------------------|---|-----------|------------|--------------|----------|
| 38 | W140 - office | Cove base - 4" black with adhesive | 21 | 5 | LF | N |
| 38 | W140 - office | Window glaze - black | 29 | 2 | Ea | N |
| 38 | W140 - office | Mastic - black mastic from former floor tile, under carpet | 34 | 165 | SF | N |
| 38 | W140 - office | carpet | 42 | 180 | SF | N |
| 39 | W141 - office | Concrete chip - poured concrete pad foundation | 3 | 180 | SF | N |
| 39 | W141 - office | Floor tile - 9" black tile with white streaks, and mastic | 4 | 15 | SF | N |
| 39 | W141 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 39 | W141 - office | Plaster - on wallboard and metal mesh at corners | 12 | 700 | SF | N |
| 39 | W141 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 700 | SF | N |
| 39 | W141 - office | Cove base - 4" black with adhesive | 21 | 5 | LF | N |
| 39 | W141 - office | Window glaze - black | 29 | 2 | Ea | N |
| 39 | W141 - office | Mastic - black mastic from former floor tile, under carpet | 34 | 165 | SF | N |
| 39 | W141 - office | carpet | 42 | 180 | SF | N |
| 40 | W141A - bathroom | Fire door - wood door | 1 | 2 | doors | A |
| 40 | W141A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 40 | W141A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 40 | W141A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 40 | W141A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 40 | W141A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 40 | W141A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 40 | W141A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 40 | W141A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 40 | W141A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |
| 40 | W141A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 40 | W141A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 40 | W141A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 40 | W141A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 40 | W141A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 41 | W142 - office | Concrete chip - poured concrete pad foundation | 3 | 180 | SF | N |
| 41 | W142 - office | Floor tile - 9" black tile with white streaks, and mastic | 4 | 15 | SF | N |
| 41 | W142 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 41 | W142 - office | Plaster - on wallboard and metal mesh at corners | 12 | 700 | SF | N |
| 41 | W142 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 700 | SF | N |
| 41 | W142 - office | Cove base - 4" black with adhesive | 21 | 5 | LF | N |
| 41 | W142 - office | Window glaze - black | 29 | 2 | Ea | N |
| 41 | W142 - office | Mastic - black mastic from former floor tile, under carpet | 34 | 165 | SF | N |

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|-----------|-------------------------|---|-----------|------------|--------------|----------|
| 41 | W142 - office | carpet | 42 | 180 | SF | N |
| 42 | W143 - office | Concrete chip - poured concrete pad foundation | 3 | 360 | SF | N |
| 42 | W143 - office | Floor tile - 9" black tile with white streaks, and mastic | 4 | 15 | SF | N |
| 42 | W143 - office | Interior caulk - red, in wall/ceiling penetrations and voids. | 8 | 1 | SF | N |
| 42 | W143 - office | Plaster - on wallboard and metal mesh at corners | 12 | 1,400 | SF | N |
| 42 | W143 - office | Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | 1,400 | SF | N |
| 42 | W143 - office | Cove base - 4" black with adhesive | 21 | 10 | LF | N |
| 42 | W143 - office | Window glaze - black | 29 | 4 | Ea | N |
| 42 | W143 - office | Mastic - black mastic from former floor tile, under carpet | 34 | 330 | SF | N |
| 42 | W143 - office | carpet | 42 | 360 | SF | N |
| 43 | W143A - bathroom | Fire door - wood door | 1 | 2 | doors | A |
| 43 | W143A - bathroom | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 43 | W143A - bathroom | Plaster - on wallboard and metal mesh at corners | 12 | 304 | SF | N |
| 43 | W143A - bathroom | Pipe insulation - paper wrapped yellow fiberglass | 14 | 75 | LF | N |
| 43 | W143A - bathroom | Pipe fitting - canvas wrapped mudded fitting | 16 | 12 | Ea | Y |
| 43 | W143A - bathroom | pattern carpet | 19 | 70 | SF | N |
| 43 | W143A - bathroom | Interior caulk - beige, around perimeter of sink | 22 | 5 | LF | Y |
| 43 | W143A - bathroom | Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | 70 | SF | N |
| 43 | W143A - bathroom | Ceramic tile, grout, mortar - 4" beige wall tile | 24 | 240 | SF | N |
| 43 | W143A - bathroom | Interior caulk - around shower perimeter | 25 | 20 | LF | N |
| 43 | W143A - bathroom | Heat shield - black, in shower light fixture | 26 | 1 | SF | N |
| 43 | W143A - bathroom | Gasket material - paper, between mirror glass and metal trim | 27 | 4 | SF | N |
| 43 | W143A - bathroom | Corrugated paper - between mirror panel and metal panel | 28 | 7 | LF | N |
| 43 | W143A - bathroom | Construction adhesive - dark beige, around shower door perimeter | 30 | 20 | LF | Y |
| 43 | W143A | Spray Applied Fire Proofing | 44 | UNQ | SF | A |
| 44 | W144 - storage | Fire door - wood door | 1 | 1 | door | A |
| 44 | W144 - storage | Concrete chip - poured concrete pad foundation | 3 | 70 | SF | N |
| 44 | W144 - storage | Floor tile - 9" black tile with white streaks, and mastic | 4 | 70 | SF | N |
| 44 | W144 - storage | Brick mortar - CMU block | 13 | 320 | SF | N |
| 44 | W144 - storage | Pipe insulation - canvas wrapped beige fiberglass | 15 | 5 | LF | N |
| 44 | W144 - storage | Pipe fitting - canvas wrapped mudded fitting | 16 | 2 | Ea | Y |
| 44 | W144 - storage | Cove base - 4" black with adhesive | 21 | 50 | LF | N |
| 45 | SW2 - stairs | Concrete chip - poured concrete pad foundation | 3 | 100 | SF | N |
| 45 | SW2 - stairs | Plaster - on wallboard and metal mesh at corners | 12 | 100 | SF | N |
| 45 | SW2 - stairs | Floor tile - 20" green tile | 35 | 80 | SF | N |
| 45 | SW2 - stairs | Stair tread - green tread | 36 | 80 | SF | N |

| FS# | FS Description | Homogeneous Area Description | HA# | Amount | Units | Asbestos |
|-----|--------------------------|--|-----|--------|-------|----------|
| 45 | SW2 - stairs | Brick mortar - red brick | 37 | 250 | SF | A |
| 46 | SW3 - stairs | Concrete chip - poured concrete pad foundation | 3 | 100 | SF | N |
| 46 | SW3 - stairs | Plaster - on wallboard and metal mesh at corners | 12 | 100 | SF | N |
| 46 | SW3 - stairs | Floor tile - 20" green tile | 35 | 80 | SF | N |
| 46 | SW3 - stairs | Stair tread - green tread | 36 | 80 | SF | N |
| 46 | SW3 - stairs | Brick mortar - red brick | 37 | 250 | SF | A |
| 47 | Wet wall - south side of | Brick mortar - red brick | 37 | 50 | SF | A |
| 47 | Wet wall - south side of | Mastic - dark grey, on wall | 43 | 20 | SF | A |

HOMOGENOUS AREA LIST

| Homogeneous Area Description | HA# | Asbestos |
|--|-----------|--------------------------------|
| Fire door - wood door | 1 | Assumed |
| Fire door - metal door | 2 | Assumed |
| Concrete chip - poured concrete pad foundation | 3 | NAD |
| Floor tile - 9" black tile with white streaks, and mastic | 4 | Assumed |
| Carpet mastic - yellow mastic under blue carpet with multi-colored specks | 5 | NAD |
| Cove base - 4" burgundy composite with adhesive | 6 | NAD-Cove Base/ NAD-Adhesive |
| Wall sheeting - canvas wall covering with criss-cross trowelled texture | 7 | NAD |
| Interior caulk - red, in wall/ceiling penetrations and voids | 8 | NAD |
| Ceiling tile - 12" white pinhole and fissure | 9 | NAD |
| Glue pods - light grey glue adhering ceiling tiles to concrete deck remaining as the original ceiling tile was removed and replaced by the light grey glue pods) | 10 | NAD |
| | 11 | NAD |
| Plaster - on wallboard and metal mesh at corners | 12 | NAD |
| Brick mortar - CMU block | 13 | NAD |
| Pipe insulation - paper wrapped yellow fiberglass | 14 | NAD |
| Pipe insulation - canvas wrapped beige fiberglass | 15 | NAD |
| Pipe fitting - canvas wrapped mudded fitting | 16 | 10% Chrysotile |
| Interior caulk - grey, around sliding door frame | 17 | NAD |
| Ceiling tile - 12" white with a rough textured pinhole and fissure pattern | 18 | NAD |
| Carpet mastic - yellow mastic under green, blue, red, and beige wave pattern carpet | 19 | NAD |
| Textured plaster - swirl and bumpy texture on walls and ceiling | 20 | NAD |
| Cove base - 4" black with adhesive | 21 | NAD-Cove Base/ NAD-Adhesive |
| Interior caulk - beige, around perimeter of sink | 22 | 2% Chrysotile |

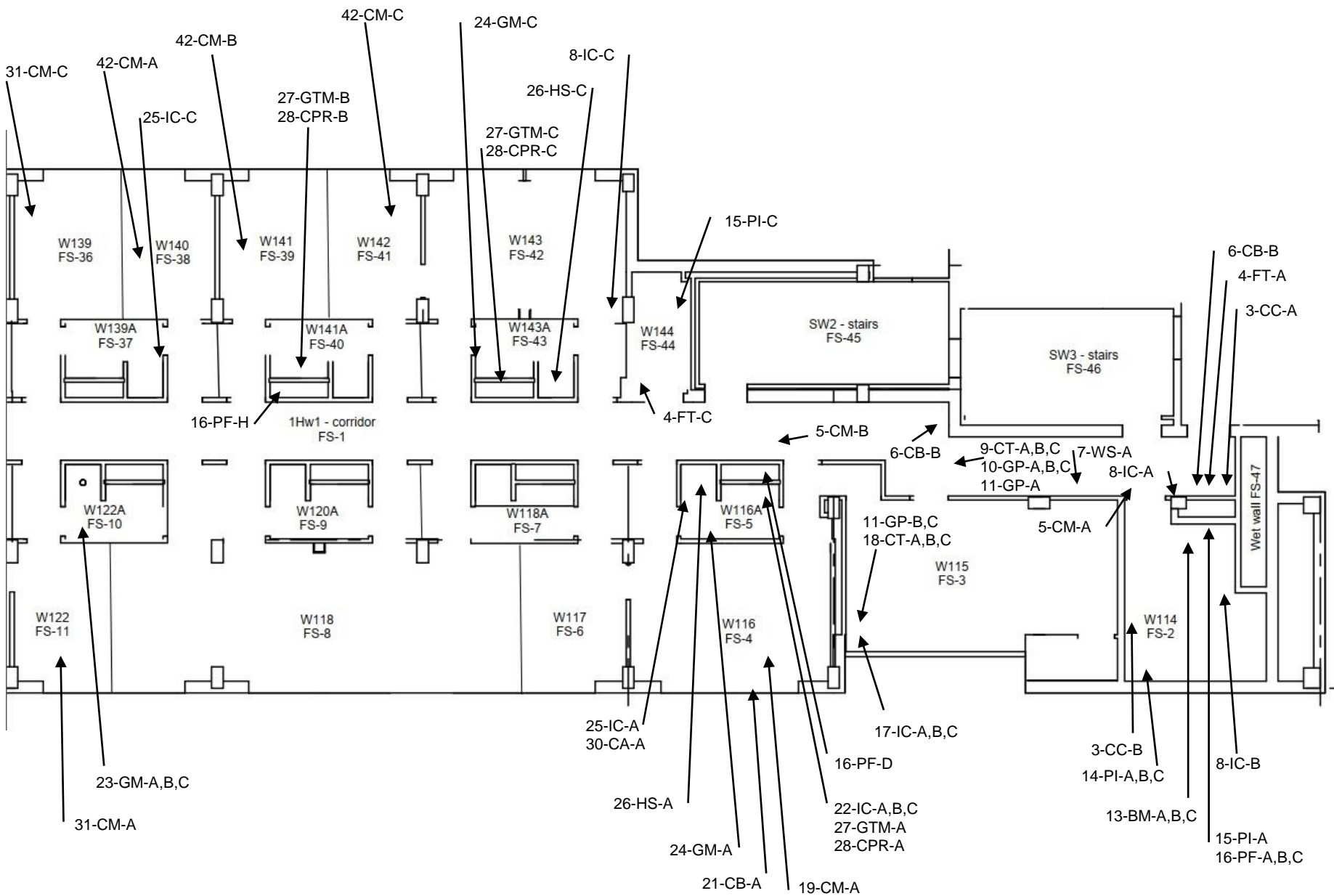
| Homogeneous Area Description | HA# | Asbestos |
|--|-----------|--|
| Ceramic tile, grout, mortar - 2" blue and green floor tile | 23 | NAD - All Layers |
| Ceramic tile, grout, mortar - 4" beige wall tile | 24 | NAD - All Layers |
| Interior caulk - around shower perimeter | 25 | NAD |
| Heat shield - black, in shower light fixture | 26 | NAD |
| Gasket material - paper, between mirror glass and metal trim | 27 | NAD |
| Corrugated paper - between mirror panel and metal panel | 28 | NAD |
| Window glaze - black | 29 | NAD |
| Construction adhesive - dark beige, around shower door perimeter | 30 | 3% Chrysotile |
| Carpet mastic - beige mastic under pink carpet | 31 | NAD |
| Carpet mastic - under striped carpet squares, earthy colors | 32 | NAD |
| Cove base - dark grey, with multiple layers of adhesive | 33 | NAD-Cove Base/ NAD-Adhesive |
| Mastic - black mastic from former floor tile, under carpet | 34 | NAD |
| Floor tile - 20" green tile | 35 | NAD |
| Stair tread - green tread | 36 | NAD |
| Brick mortar - red brick | 37 | Assumed |
| Window glaze - white | 38 | NAD |
| Ceramic tile, grout, mortar - 1" brown floor tile | 39 | Assumed |
| Ceramic tile, grout, mortar - 4" peach wall tile | 40 | Assumed |
| Hanger mud - white mud around pipe insulation at hanging hardware | 41 | 5% Chrysotile |
| Carpet mastic - beige mastic under green, beige, and black speckled carpet | 42 | NAD |
| Mastic - dark grey, on wall | 43 | Assumed |
| Spray Applied Fire Proofing | 44 | Assumed |

FUNCTIONAL SPACE LIST

MSU Owen Hall
Functional Space Listing

| FS# | FS Description |
|-----|----------------|
| 1 | 1HW1 |
| 2 | W114 |
| 3 | W115 |
| 4 | W116 |
| 5 | W116A |
| 6 | W117 |
| 7 | W118A |
| 8 | W118 |
| 9 | W120A |
| 10 | W122A |
| 11 | W122 |
| 12 | W123 |
| 13 | W124A |
| 14 | W124 |
| 15 | W125 |
| 16 | W126A |
| 17 | W126 |
| 18 | W127 |
| 19 | W128A |
| 20 | W128 |
| 21 | W130A |
| 22 | W130 |
| 23 | W2 |
| 24 | W130B |
| 25 | W131 |
| 26 | W131A |
| 27 | W133 |
| 28 | W133A |
| 29 | W134 |
| 30 | W135 |
| 31 | W135A |
| 32 | W136 |
| 33 | W137 |
| 34 | W137A |
| 35 | W138 |
| 36 | W139 |
| 37 | W139A |
| 38 | W140 |
| 39 | W141 |
| 40 | W141A |
| 41 | W142 |
| 42 | W143 |
| 43 | W143A |
| 44 | W144 |
| 45 | SW2 |
| 46 | SW3 |
| 47 | Wet Wall |

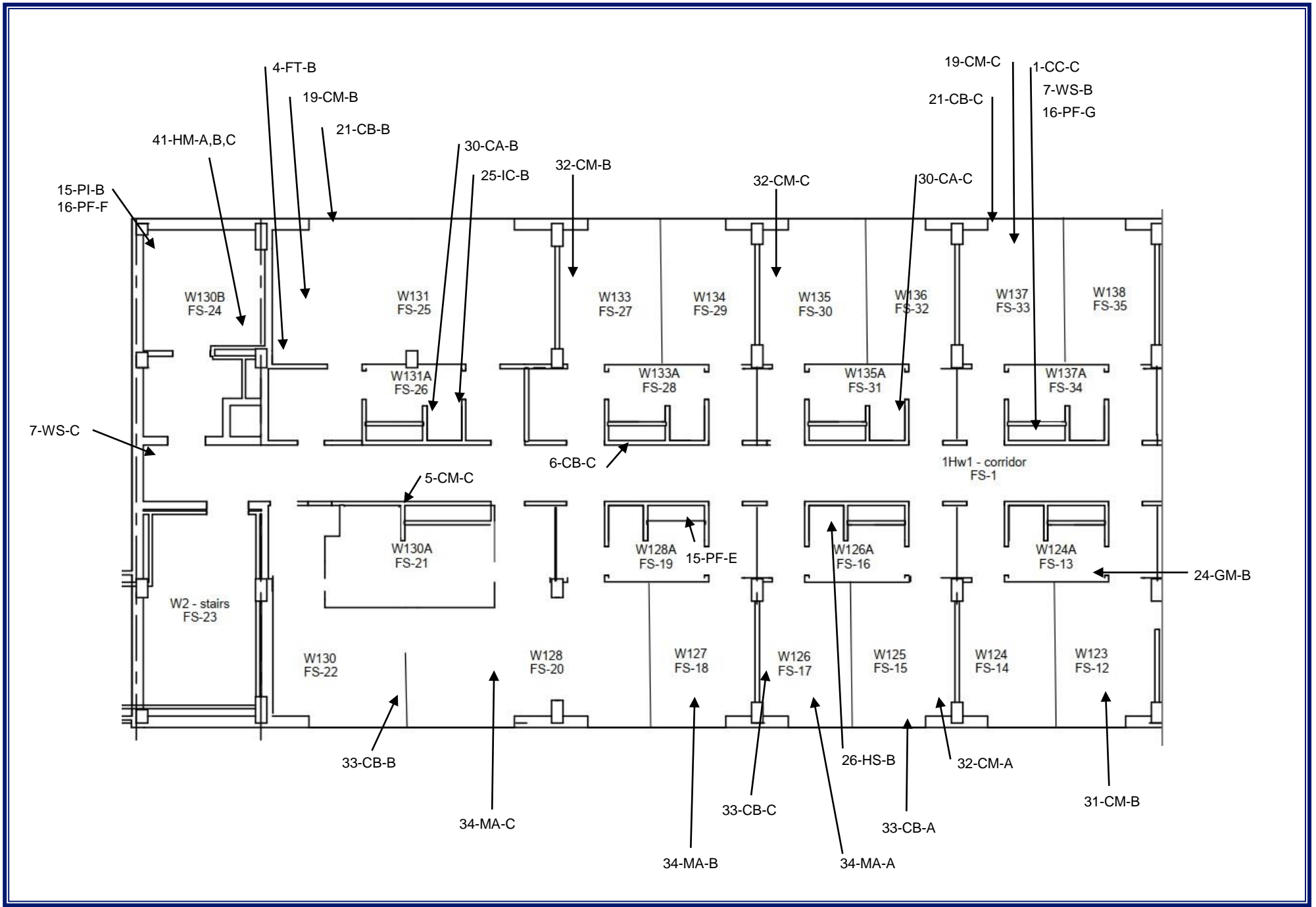
APPENDIX II DRAWINGS



Michigan State University
 Owen Hall
 735 E Shaw Lane
 East Lansing, Michigan 48825

Asbestos Bulk sampling location Map
 Owen Hall, 1st level, north portion

| | |
|---|----------------|
| PROJECT NUMBER: NA | FIGURE: 1 OF 1 |
| 46555 Humboldt Drive, Suite 100 Novi, Michigan 48377 Ph: (248) 669-5140 ~ Fax: (248) 669-5147 | |



Michigan State University
 Owen Hall
 735 E Shaw Lane
 East Lansing, Michigan 48825

Asbestos Bulk sampling location Map
 Owen Hall, 1st level, north portion

| | |
|---|----------------|
| PROJECT NUMBER: NA | FIGURE: 1 OF 1 |
| 46555 Humboldt Drive, Suite 100 Novi, Michigan 48377 Ph: (248) 669-5140 ~ Fax: (248) 669-5147 | |

APPENDIX III
LABORATORY DOCUMENTATION



To: Atlas - Novi
46555 Humboldt Dr. Suite 100
Novi, Michigan 48377

ETL Job: 253908
Client Project: 188BS
Report Date: 2/7/2023

Attention: Robert Smith
Project Location: Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Lab Sample Number | Client Sample Number | Sample Type | Completed |
|-------------------|----------------------|-------------|------------|
| 1441191 | 3-CC-A | Asbestos | 01/11/2023 |
| 1441192 | 3-CC-B | Asbestos | 01/11/2023 |
| 1441193 | 3-CC-C | Asbestos | 01/11/2023 |
| 1441194 | 4-FT-A | Asbestos | 01/11/2023 |
| 1441195 | 4-FT-B | Asbestos | 01/11/2023 |
| 1441196 | 4-FT-C | Asbestos | 01/11/2023 |
| 1441197 | 5-CM-A | Asbestos | 01/11/2023 |
| 1441198 | 5-CM-B | Asbestos | 01/11/2023 |
| 1441199 | 5-CM-C | Asbestos | 01/11/2023 |
| 1441200 | 6-CB-A | Asbestos | 01/11/2023 |
| 1441201 | 6-CB-B | Asbestos | 01/11/2023 |
| 1441202 | 6-CB-C | Asbestos | 01/11/2023 |
| 1441203 | 7-WS-A | Asbestos | 01/11/2023 |
| 1441204 | 7-WS-B | Asbestos | 01/11/2023 |
| 1441205 | 7-WS-C | Asbestos | 01/11/2023 |
| 1441206 | 8-IC-A | Asbestos | 01/11/2023 |


| Lab Sample Number | Client Sample Number | Sample Type | Completed |
|-------------------|----------------------|-------------|------------|
| 1441207 | 8-IC-B | Asbestos | 01/11/2023 |
| 1441208 | 8-IC-C | Asbestos | 01/11/2023 |
| 1441209 | 9-CT-A | Asbestos | 01/11/2023 |
| 1441210 | 9-CT-B | Asbestos | 01/11/2023 |
| 1441211 | 9-CT-C | Asbestos | 01/11/2023 |
| 1441212 | 10-GP-A | Asbestos | 01/11/2023 |
| 1441213 | 10-GP-B | Asbestos | 01/11/2023 |
| 1441214 | 10-GP-C | Asbestos | 01/11/2023 |
| 1441215 | 11-GP-A | Asbestos | 01/11/2023 |
| 1441216 | 11-GP-B | Asbestos | 01/11/2023 |
| 1441217 | 11-GP-C | Asbestos | 01/11/2023 |
| 1441218 | 13-BM-A | Asbestos | 01/11/2023 |
| 1441219 | 13-BM-B | Asbestos | 01/11/2023 |
| 1441220 | 13-BM-C | Asbestos | 01/11/2023 |
| 1441221 | 14-PI-A | Asbestos | 01/11/2023 |
| 1441222 | 14-PI-B | Asbestos | 01/11/2023 |
| 1441223 | 14-PI-C | Asbestos | 01/11/2023 |
| 1441224 | 15-PI-A | Asbestos | 01/11/2023 |
| 1441225 | 15-PI-B | Asbestos | 01/11/2023 |
| 1441226 | 15-PI-C | Asbestos | 01/11/2023 |
| 1441227 | 16-PF-A | Asbestos | 01/11/2023 |
| 1441228 | 16-PF-B | Asbestos | 02/07/2023 |
| 1441229 | 16-PF-C | Asbestos | 02/07/2023 |
| 1441230 | 16-PF-D | Asbestos | 02/07/2023 |
| 1441231 | 16-PF-E | Asbestos | 02/07/2023 |
| 1441232 | 16-PF-F | Asbestos | 02/07/2023 |

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| Lab Sample Number | Client Sample Number | Sample Type | Completed |
|-------------------|----------------------|-------------|------------|
| 1441233 | 16-PF-G | Asbestos | 02/07/2023 |
| 1441234 | 16-PF-H | Asbestos | 02/07/2023 |
| 1441235 | 17-IC-A | Asbestos | 01/11/2023 |
| 1441236 | 17-IC-B | Asbestos | 01/11/2023 |
| 1441237 | 17-IC-C | Asbestos | 01/11/2023 |
| 1441238 | 18-CT-A | Asbestos | 01/11/2023 |
| 1441239 | 18-CT-B | Asbestos | 01/11/2023 |
| 1441240 | 18-CT-C | Asbestos | 01/11/2023 |
| 1441241 | 19-CM-A | Asbestos | 01/11/2023 |
| 1441242 | 19-CM-B | Asbestos | 01/11/2023 |
| 1441243 | 19-CM-C | Asbestos | 01/11/2023 |
| 1441244 | 21-CB-A | Asbestos | 01/11/2023 |
| 1441245 | 21-CB-B | Asbestos | 01/11/2023 |
| 1441246 | 21-CB-C | Asbestos | 01/11/2023 |
| 1441247 | 22-IC-A | Asbestos | 01/11/2023 |
| 1441248 | 22-IC-B | Asbestos | 02/07/2023 |
| 1441249 | 22-IC-C | Asbestos | 02/07/2023 |
| 1441250 | 23-GM-A | Asbestos | 01/11/2023 |
| 1441251 | 23-GM-B | Asbestos | 01/11/2023 |
| 1441252 | 23-GM-C | Asbestos | 01/11/2023 |
| 1441253 | 24-GM-A | Asbestos | 01/11/2023 |
| 1441254 | 24-GM-B | Asbestos | 01/11/2023 |
| 1441255 | 24-GM-C | Asbestos | 01/11/2023 |
| 1441256 | 25-IC-A | Asbestos | 01/11/2023 |
| 1441257 | 25-IC-B | Asbestos | 01/11/2023 |
| 1441258 | 25-IC-C | Asbestos | 01/11/2023 |

| Lab Sample Number | Client Sample Number | Sample Type | Completed |
|-------------------|----------------------|-------------|------------|
| 1441259 | 26-HS-A | Asbestos | 01/11/2023 |
| 1441260 | 26-HS-B | Asbestos | 01/11/2023 |
| 1441261 | 26-HS-C | Asbestos | 01/11/2023 |
| 1441262 | 27-GTM-A | Asbestos | 01/11/2023 |
| 1441263 | 27-GTM-B | Asbestos | 01/11/2023 |
| 1441264 | 27-GTM-C | Asbestos | 01/11/2023 |
| 1441265 | 28-CPR-A | Asbestos | 01/11/2023 |
| 1441266 | 28-CPR-B | Asbestos | 01/11/2023 |
| 1441267 | 28-CPR-C | Asbestos | 01/11/2023 |
| 1441268 | 30-CA-A | Asbestos | 01/11/2023 |
| 1441269 | 30-CA-B | Asbestos | 02/07/2023 |
| 1441270 | 30-CA-C | Asbestos | 02/07/2023 |
| 1441271 | 31-CM-A | Asbestos | 01/11/2023 |
| 1441272 | 31-CM-B | Asbestos | 01/11/2023 |
| 1441273 | 31-CM-C | Asbestos | 01/11/2023 |
| 1441274 | 32-CM-A | Asbestos | 01/11/2023 |
| 1441275 | 32-CM-B | Asbestos | 01/11/2023 |
| 1441276 | 32-CM-C | Asbestos | 01/11/2023 |
| 1441277 | 33-CB-A | Asbestos | 01/11/2023 |
| 1441278 | 33-CB-B | Asbestos | 01/11/2023 |
| 1441279 | 33-CB-C | Asbestos | 01/11/2023 |
| 1441280 | 34-MA-A | Asbestos | 01/11/2023 |
| 1441281 | 34-MA-B | Asbestos | 01/11/2023 |
| 1441282 | 34-MA-C | Asbestos | 01/11/2023 |
| 1441283 | 41-HM-A | Asbestos | 01/11/2023 |
| 1441284 | 41-HM-B | Asbestos | 02/07/2023 |

| Lab Sample Number | Client Sample Number | Sample Type | Completed |
|-------------------|----------------------|-------------|------------|
| 1441285 | 41-HM-C | Asbestos | 02/07/2023 |
| 1441286 | 42-CM-A | Asbestos | 01/11/2023 |
| 1441287 | 42-CM-B | Asbestos | 01/11/2023 |
| 1441288 | 42-CM-C | Asbestos | 01/11/2023 |

Reviewed by: 
Emily Nowacki

Summary

| Method | Sample | Layer | Mastic |
|--------|--------|-------|--------|
| PLM | 110 | 3 | 14 |

Polarized Light Microscopy Asbestos Analysis Report

To : Atlas - Novi
 46555 Humboldt Dr. Suite 100
 Novi, Michigan 48377

ETL Job : 253908
Client Project : 188BS
Date Collected : 01/04/2023
Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|---------------|-------------------------------------|------------------|---------------|-------------------|
| 1441191 3-CC-A | Concrete Chip | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441192 3-CC-B | Concrete Chip | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441193 3-CC-C | Concrete Chip | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441194 4-FT-A | Floor Tile | Black Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441194 4-FT-A | Adhesive | Yellow Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Polarized Light Microscopy Asbestos Analysis Report

To : Atlas - Novi
 46555 Humboldt Dr. Suite 100
 Novi, Michigan 48377

ETL Job : 253908
Client Project : 188BS
Date Collected : 01/04/2023
Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|---------------|-------------------------------------|------------------|---------------|-------------------|
| 1441195 4-FT-B | Floor Tile | Black Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441195 4-FT-B | Adhesive | Yellow Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441196 4-FT-C | Floor Tile | Black Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441197 5-CM-A | Carpet Mastic | Yellow Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441198 5-CM-B | Carpet Mastic | Yellow Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441199 5-CM-C | Carpet Mastic | Yellow Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|-------------|-------------------------------------|------------------|---------------|-------------------|
| 1441200 6-CB-A | Cove Base | Brown Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441200 6-CB-A | Adhesive | Yellow Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441201 6-CB-B | Cove Base | Brown Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441201 6-CB-B | Adhesive | Yellow Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441202 6-CB-C | Cove Base | Brown Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441202 6-CB-C | Adhesive | Yellow Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|----------------|----------------------------------|-------------------|---------------|-------------------|
| 1441203 7-WS-A | Wall Sheeting | White Fibrous Homogenous | PLM 25% Cellulose | PLM 75% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441204 7-WS-B | Wall Sheeting | White Fibrous Homogenous | PLM 25% Cellulose | PLM 75% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441205 7-WS-C | Wall Sheeting | White Fibrous Homogenous | PLM 25% Cellulose | PLM 75% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441206 8-IC-A | Interior Caulk | Red Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441207 8-IC-B | Interior Caulk | Red Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441208 8-IC-C | Interior Caulk | Red Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|--------------|-----------------------------------|-------------------|---------------|-------------------|
| 1441209 9-CT-A | Ceiling Tile | White Fibrous Homogenous | PLM 90% Cellulose | PLM 10% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441210 9-CT-B | Ceiling Tile | White Fibrous Homogenous | PLM 90% Cellulose | PLM 10% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441211 9-CT-C | Ceiling Tile | White Fibrous Homogenous | PLM 90% Cellulose | PLM 10% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441212 10-GP-A | Glue Pod | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441213 10-GP-B | Glue Pod | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441214 10-GP-C | Glue Pod | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|--------------|------------------------------------|------------------|---------------|-------------------|
| 1441215 11-GP-A | Glue Pod | Brown Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441216 11-GP-B | Glue Pod | Brown Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441217 11-GP-C | Glue Pod | Brown Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441218 13-BM-A | Brick Mortar | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441219 13-BM-B | Brick Mortar | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441220 13-BM-C | Brick Mortar | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Date Received : 01/09/2023

Location :
 Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|-----------------|---------------------------------|--|---------------|-------------------|
| 1441221 14-PI-A | Pipe Insulation | Yellow Fibrous Homogenous | PLM 1% Cellulose PLM 98% Fiberglass | PLM 1% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441222 14-PI-B | Pipe Insulation | Yellow Fibrous Homogenous | PLM 1% Cellulose PLM 98% Fiberglass | PLM 1% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441223 14-PI-C | Pipe Insulation | Yellow Fibrous Homogenous | PLM 1% Cellulose PLM 98% Fiberglass | PLM 1% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441224 15-PI-A | Pipe Insulation | Yellow Fibrous Homogenous | PLM 1% Cellulose PLM 98% Fiberglass | PLM 1% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441224 15-PI-A | Paper Back | White Fibrous Homogenous | PLM 90% Cellulose | PLM 10% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Date Received : 01/09/2023

Location :
 Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|-----------------|---------------------------------|--|---------------|--------------------|
| 1441225 15-PI-B | Pipe Insulation | Yellow Fibrous Homogenous | PLM 1% Cellulose PLM 98% Fiberglass | PLM 1% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441225 15-PI-B | Paper Back | White Fibrous Homogenous | PLM 90% Cellulose | PLM 10% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441226 15-PI-C | Pipe Insulation | Yellow Fibrous Homogenous | PLM 1% Cellulose PLM 98% Fiberglass | PLM 1% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441226 15-PI-C | Paper Back | White Fibrous Homogenous | PLM 90% Cellulose | PLM 10% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441227 16-PF-A | Pipe Fitting | Gray Fibrous Homogenous | PLM 10% Cellulose | PLM 80% Other | PLM 10% Chrysotile |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441228 16-PF-B | Pipe Fitting | Gray Fibrous Homogenous | PLM 3% Cellulose PLM 20% Fiberglass | PLM 69% Other | PLM 8% Chrysotile |
| Layer-1 Analyst: James Farinas Date Analyzed : 02/07/2023 | | | | | |

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Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|--|--------------|-------------------------------|--|---------------|--------------------|
| 1441229 16-PF-C | Pipe Fitting | Gray Fibrous Homogenous | PLM 3% Cellulose PLM 20% Fiberglass | PLM 62% Other | PLM 15% Chrysotile |
| Layer-1 Analyst: James Farinas Date Analyzed : 02/07/2023 | | | | | |
| 1441230 16-PF-D | Pipe Fitting | Gray Fibrous Homogenous | PLM 3% Cellulose PLM 15% Fiberglass | PLM 62% Other | PLM 20% Chrysotile |
| Layer-1 Analyst: James Farinas Date Analyzed : 02/07/2023 | | | | | |
| 1441231 16-PF-E | Pipe Fitting | Gray Fibrous Homogenous | PLM 5% Cellulose PLM 25% Fiberglass | PLM 62% Other | PLM 8% Chrysotile |
| Layer-1 Analyst: James Farinas Date Analyzed : 02/07/2023 | | | | | |
| 1441232 16-PF-F | Pipe Fitting | Gray Fibrous Homogenous | PLM 3% Cellulose PLM 20% Fiberglass | PLM 62% Other | PLM 15% Chrysotile |
| Layer-1 Analyst: James Farinas Date Analyzed : 02/07/2023 | | | | | |
| 1441233 16-PF-G | Pipe Fitting | Gray Fibrous Homogenous | PLM 3% Cellulose PLM 45% Fiberglass | PLM 39% Other | PLM 13% Chrysotile |
| Layer-1 Analyst: James Farinas Date Analyzed : 02/07/2023 | | | | | |
| 1441234 16-PF-H | Pipe Fitting | Gray Fibrous Homogenous | PLM 3% Cellulose PLM 35% Fiberglass | PLM 52% Other | PLM 10% Chrysotile |
| Layer-1 Analyst: James Farinas Date Analyzed : 02/07/2023 | | | | | |

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Location :

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| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|----------------|-----------------------------------|--|---------------|-------------------|
| 1441235 17-IC-A | Interior Caulk | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441236 17-IC-B | Interior Caulk | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441237 17-IC-C | Interior Caulk | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441238 18-CT-A | Ceiling Tile | White Fibrous Homogenous | PLM 3% Cellulose PLM 95% Mineral wool | PLM 2% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441239 18-CT-B | Ceiling Tile | White Fibrous Homogenous | PLM 2% Cellulose PLM 95% Mineral wool | PLM 3% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441240 18-CT-C | Ceiling Tile | White Fibrous Homogenous | PLM 3% Cellulose PLM 95% Mineral wool | PLM 2% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|---------------|-------------------------------------|------------------|---------------|-------------------|
| 1441241 19-CM-A | Carpet Mastic | Yellow Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441242 19-CM-B | Carpet Mastic | Yellow Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441243 19-CM-C | Carpet Mastic | Yellow Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441244 21-CB-A | Cove Base | Black Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441244 21-CB-A | Adhesive | Yellow Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Polarized Light Microscopy Asbestos Analysis Report

To : Atlas - Novi
 46555 Humboldt Dr. Suite 100
 Novi, Michigan 48377

ETL Job : 253908
Client Project : 188BS
Date Collected : 01/04/2023
Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|----------------|-------------------------------------|------------------|---------------|-------------------|
| 1441245 21-CB-B | Cove Base | Black Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441245 21-CB-B | Adhesive | Yellow Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441246 21-CB-C | Cove Base | Black Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441246 21-CB-C | Adhesive | Yellow Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441247 22-IC-A | Interior Caulk | Beige Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 97% Other | PLM 2% Chrysotile |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441248 22-IC-B | Interior Caulk | Beige Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 95% Other | PLM 3% Chrysotile |
| Layer-1 Analyst: James Farinas Date Analyzed : 02/07/2023 | | | | | |

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Polarized Light Microscopy Asbestos Analysis Report

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 Novi, Michigan 48377

ETL Job : 253908
Client Project : 188BS
Date Collected : 01/04/2023
Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|----------------|------------------------------------|------------------|---------------|-------------------|
| 1441249 22-IC-C | Interior Caulk | Beige Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 96% Other | PLM 2% Chrysotile |
| Layer-1 Analyst: James Farinas Date Analyzed : 02/07/2023 | | | | | |
| 1441250 23-GM-A | Ceramic Tile | Blue Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441250 23-GM-A | Grout | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441250 23-GM-A | Mortar | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-3 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Polarized Light Microscopy Asbestos Analysis Report

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 46555 Humboldt Dr. Suite 100
 Novi, Michigan 48377

ETL Job : 253908
Client Project : 188BS
Date Collected : 01/04/2023
Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|--------------|-----------------------------------|------------------|---------------|-------------------|
| 1441251 23-GM-B | Ceramic Tile | Blue Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441251 23-GM-B | Grout | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441251 23-GM-B | Mortar | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-3 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441252 23-GM-C | Ceramic Tile | Blue Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441252 23-GM-C | Grout | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441252 23-GM-C | Mortar | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-3 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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 Novi, Michigan 48377

ETL Job : 253908
Client Project : 188BS
Date Collected : 01/04/2023
Date Received : 01/09/2023

Location :
 Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|--------------|------------------------------------|------------------|---------------|-------------------|
| 1441253 24-GM-A | Ceramic Tile | White Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441253 24-GM-A | Grout | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441253 24-GM-A | Mortar | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-3 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441254 24-GM-B | Ceramic Tile | White Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441254 24-GM-B | Grout | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441254 24-GM-B | Mortar | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-3 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Client Project : 188BS
Date Collected : 01/04/2023
Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|----------------|------------------------------------|------------------|---------------|-------------------|
| 1441255 24-GM-C | Ceramic Tile | White Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441255 24-GM-C | Grout | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441255 24-GM-C | Mortar | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-3 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441256 25-IC-A | Interior Caulk | White Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441257 25-IC-B | Interior Caulk | White Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441258 25-IC-C | Interior Caulk | White Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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ETL Job : 253908
Client Project : 188BS
Date Collected : 01/04/2023
Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|-----------------|------------------------------------|-------------------|---------------|-------------------|
| 1441259 26-HS-A | Heat Shield | Black Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441260 26-HS-B | Heat Shield | Black Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441261 26-HS-C | Heat Shield | Black Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441262 27-GTM-A | Gasket Material | Brown Fibrous Homogenous | PLM 90% Cellulose | PLM 10% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441263 27-GTM-B | Gasket Material | Brown Fibrous Homogenous | PLM 90% Cellulose | PLM 10% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441264 27-GTM-C | Gasket Material | Brown Fibrous Homogenous | PLM 90% Cellulose | PLM 10% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Date Received : 01/09/2023

Location :
 Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|-----------------------|------------------------------------|-------------------|---------------|-------------------|
| 1441265 28-CPR-A | Corrugated Paper | Brown Fibrous Homogenous | PLM 90% Cellulose | PLM 10% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441266 28-CPR-B | Corrugated Paper | Brown Fibrous Homogenous | PLM 90% Cellulose | PLM 10% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441267 28-CPR-C | Corrugated Paper | Brown Fibrous Homogenous | PLM 90% Cellulose | PLM 10% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441268 30-CA-A | Construction Adhesive | Beige Non-Fibrous Homogenous | PLM 3% Cellulose | PLM 94% Other | PLM 3% Chrysotile |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441269 30-CA-B | Construction Adhesive | Beige Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 97% Other | PLM 2% Chrysotile |
| Layer-1 Analyst: James Farinas Date Analyzed : 02/07/2023 | | | | | |
| 1441270 30-CA-C | Construction Adhesive | Beige Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 96% Other | PLM 2% Chrysotile |
| Layer-1 Analyst: James Farinas Date Analyzed : 02/07/2023 | | | | | |

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ETL Job : 253908
Client Project : 188BS
Date Collected : 01/04/2023
Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|---------------|------------------------------------|------------------|---------------|-------------------|
| 1441271 31-CM-A | Carpet Mastic | Beige Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441272 31-CM-B | Carpet Mastic | Beige Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441273 31-CM-C | Carpet Mastic | Beige Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441274 32-CM-A | Carpet Mastic | Gray Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441275 32-CM-B | Carpet Mastic | Gray Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441276 32-CM-C | Carpet Mastic | Gray Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Client Project : 188BS
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Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|-------------|------------------------------------|------------------|---------------|-------------------|
| 1441277 33-CB-A | Cove Base | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441277 33-CB-A | Adhesive | Brown Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441277 33-CB-A | Adhesive | Tan Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-3 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441278 33-CB-B | Cove Base | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441278 33-CB-B | Adhesive | Brown Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441278 33-CB-B | Adhesive | Tan Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-3 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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ETL Job : 253908
Client Project : 188BS
Date Collected : 01/04/2023
Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|-------------|------------------------------------|------------------|---------------|-------------------|
| 1441279 33-CB-C | Cove Base | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441279 33-CB-C | Adhesive | Brown Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-2 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441279 33-CB-C | Adhesive | Tan Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Layer-3 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441280 34-MA-A | Mastic | Black Non-Fibrous Homogenous | PLM 3% Cellulose | PLM 97% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441281 34-MA-B | Mastic | Black Non-Fibrous Homogenous | PLM 2% Cellulose | PLM 98% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441282 34-MA-C | Mastic | Black Non-Fibrous Homogenous | PLM 3% Cellulose | PLM 97% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Polarized Light Microscopy Asbestos Analysis Report

To : Atlas - Novi
 46555 Humboldt Dr. Suite 100
 Novi, Michigan 48377

ETL Job : 253908
Client Project : 188BS
Date Collected : 01/04/2023
Date Received : 01/09/2023

Location :

Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|---------------|------------------------------------|--|---------------|--------------------|
| 1441283 41-HM-A | Hanger Mud | White Fibrous Homogenous | PLM 5% Cellulose PLM 10% Fiberglass | PLM 80% Other | PLM 5% Chrysotile |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441284 41-HM-B | Hanger Mud | White Fibrous Homogenous | PLM 3% Cellulose PLM 40% Fiberglass | PLM 47% Other | PLM 10% Chrysotile |
| Layer-1 Analyst: James Farinas Date Analyzed : 02/07/2023 | | | | | |
| 1441285 41-HM-C | Hanger Mud | White Fibrous Homogenous | PLM 2% Cellulose PLM 25% Fiberglass | PLM 63% Other | PLM 10% Chrysotile |
| Layer-1 Analyst: James Farinas Date Analyzed : 02/07/2023 | | | | | |
| 1441286 42-CM-A | Carpet Mastic | Beige Non-Fibrous Homogenous | PLM 3% Cellulose | PLM 97% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441287 42-CM-B | Carpet Mastic | Beige Non-Fibrous Homogenous | PLM 3% Cellulose | PLM 97% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |
| 1441288 42-CM-C | Carpet Mastic | Beige Non-Fibrous Homogenous | PLM 3% Cellulose | PLM 97% Other | PLM None Detected |
| Layer-1 Analyst: Erin Danhausen Date Analyzed : 01/11/2023 | | | | | |

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Polarized Light Microscopy Asbestos Analysis Report

To : Atlas - Novi
 46555 Humboldt Dr. Suite 100
 Novi, Michigan 48377


ETL Job : 253908
Client Project : 188BS
Date Collected : 01/04/2023
Date Received : 01/09/2023


Location :
 Owen Hall, West Wing, 1st Level; Michigan State University, East Lansing, MI

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|--------|-------------|------------|-----------|---------------|------------|
|--------|-------------|------------|-----------|---------------|------------|


 Lab Supervisor/Other Signatory

Analyst:


 Erin Danhausen


 James Farinas

400 Point Count Results by EPA 600/R-93/116 PLM (denoted by "PC")
 Item 198.1: PLM Methods for Identifying and Quantitating Asbestos in Bulk Samples
 Item 198.6: PLM Methods for Identifying and Quantitating Asbestos in Non-Friable Organically Bound Bulk Samples
 EPA 600/R-93/116: Method for Determination of Asbestos in Bulk Building Materials
 EPA 600/M4-82-020: Interim Method for Determination of Asbestos in Bulk Insulation Samples
 A % Asbestos result of "Trace" indicates that the analyzed material was found to contain less than 1% asbestos and would not be considered an Asbestos Containing Material (ACM).

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**Bulk Asbestos
Chain of Custody**

ETL Project #: 253908

| | | | | |
|---------|-----------------------------|--|------------------------|---------------------------------|
| Client: | Atlas Technical Consultants | Contact: Rob Smith | Project Location/name: | MICHIGAN STATE UNIVERSITY, OWEN |
| | Address: | 46555 Humboldt Dr. Ste. 100 Novi, MI 48377 | | Phone: 248-669-5140 |
| | | | Fax: 248-669-5147 | Client Project #: 188B5 |
| | | E-mail: | Date Sampled: | 1.4.2023 |

Turnaround Time (TAT): RUSH Same Day 24 hr 48 hr Standard (3-5 days) Other 72 hours

PLM Instructions
(Check all that apply)

| | |
|--|--|
| <input checked="" type="checkbox"/> PLM EPA600/R-93/116, 1993 (Standard method) | <input checked="" type="checkbox"/> Stop at 1st Positive - <i>Clearly mark Homogenous Group</i> |
| Point Counting: <input type="checkbox"/> 400 Points* <input type="checkbox"/> NYSDOH ELAP 198.1, 2002* | |
| <input type="checkbox"/> Gravimetric Reduction* <input type="checkbox"/> NYSDOH ELAP 198.6, 2010* | |
| <input type="checkbox"/> PLM Non-Building Material (Dust, Wipe, Tape) | <input type="checkbox"/> Soil or Vermiculite Analysis* |

* Additional charge and turnaround may be required

| Lab ID | Sample ID | Material Description | Sample Location | Quantity |
|---------|-----------------|---|-----------------|----------|
| | 1 - NOT SAMPLED | Fire door - wood door | NA | NA |
| | 2 - NOT SAMPLED | Fire door - metal fire door | NA | NA |
| 1441191 | 3-CC-A | Concrete chip - poured concrete pad foundation | FS-1 | NA |
| 192 | 3-CC-B | Concrete chip - poured concrete pad foundation | FS-2 | NA |
| 193 | 3-CC-C | Concrete chip - poured concrete pad foundation | FS-34 | NA |
| 194 | 4-FT-A | Floor tile - 9" black tile with white streaks | FS-1 | NA |
| 195 | 4-FT-B | Floor tile - 9" black tile with white streaks | FS-25 | NA |
| 196 | 4-FT-C | Floor tile - 9" black tile with white streaks | FS-44 | NA |
| 197 | 5-CM-A | Carpet mastic - yellow mastic under blue carpet with multi-colored specks | FS-1 | NA |
| 198 | 5-CM-B | Carpet mastic - yellow mastic under blue carpet with multi-colored specks | FS-1 | NA |
| 199 | 5-CM-C | Carpet mastic - yellow mastic under blue carpet with multi-colored specks | FS-1 | NA |
| 200 | 6-CB-A | Cove base - 4" composite with adhesive | FS-1 | NA |

| | Date | Time |
|--|-------------------------|---------------------|
| Relinquished (Name/Organization): | Andrew DeLodder / Atlas | 1.5.2022 1600 am/pm |
| Received (Name/ETL): | <i>Boena Separeto</i> | 1-9-23 10:00 am/pm |
| Sample Login (Name/ETL): | <i>Boena Separeto</i> | 1-9-23 11:00 am/pm |
| Stereoscopic/Sample Analysis (Name/ETL): | <i>[Signature]</i> | 1/12/23 7:45 am/pm |
| Results (Name/ETL): | <i>[Signature]</i> | 1/12/23 7:45 am/pm |
| QA/QC Review (Name/ETL): | <i>[Signature]</i> | 1-12-23 0940 am/pm |

| | |
|---|---------|
| <p>Special Instructions: • 1st Positive Stop; • Composite all drywall/joint compound samples if any layer of system is greater than 1% asbestos; • Point Count ALL PLASTER samples Trace to 3% asbestos content • Point Count ALL SAMPLES Trace to 1% asbestos content</p> | Remarks |
|---|---------|

**IN ORDER TO ENSURE RESULTS BY SPECIFIED TAT, THE LAB MUST BE EMAILED/CALLED WITH THE QUANTITY OF SAMPLES TO BE SHIPPED OR DROPPED OFF

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**Bulk Asbestos
 Chain of Custody**

ETL Project #: **253908**

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

| Lab ID | Sample ID | Material Description | Sample Location | Quantity |
|---------|------------------|--|-----------------|----------|
| 1441201 | 6-CB-B | Cove base - 4" composite with adhesive | FS-1 | NA |
| 202 | 6-CB-C | Cove base - 4" composite with adhesive | FS-1 | NA |
| 203 | 7-WS-A | Wall sheeting - canvas wall covering with criss-cross trowelled texture | FS-1 | NA |
| 204 | 7-WS-B | Wall sheeting - canvas wall covering with criss-cross trowelled texture | FS-1 | NA |
| 205 | 7-WS-C | Wall sheeting - canvas wall covering with criss-cross trowelled texture | FS-1 | NA |
| 206 | 8-IC-A | Interior caulk - red, in wall/ceiling penetrations and voids. | FS-1 | NA |
| 207 | 8-IC-B | Interior caulk - red, in wall/ceiling penetrations and voids. | FS-2 | NA |
| 208 | 8-IC-C | Interior caulk - red, in wall/ceiling penetrations and voids. | FS-24 | NA |
| 209 | 9-CT-A | Ceiling tile - 12" white pinhole and fissure | FS-1 | NA |
| 210 | 9-CT-B | Ceiling tile - 12" white pinhole and fissure | FS-1 | NA |
| 211 | 9-CT-C | Ceiling tile - 12" white pinhole and fissure | FS-1 | NA |
| 212 | 10-GP-A | Glue pods - light grey glue adhering ceiling tiles t concrete deck | FS-1 | NA |
| 213 | 10-GP-B | Glue pods - light grey glue adhering ceiling tiles t concrete deck | FS-1 | NA |
| 214 | 10-GP-C | Glue pods - light grey glue adhering ceiling tiles t concrete deck | FS-1 | NA |
| 215 | 11-GP-A | Glue pods - light brown, remnants of previous glue pods that were replaced by the light grey glue pods | FS-1 | NA |
| 216 | 11-GP-B | Glue pods - light brown, remnants of previous glue pods that were replaced by the light grey glue pods | FS-3 | NA |
| 217 | 11-GP-C | Glue pods - light brown, remnants of previous glue pods that were replaced by the light grey glue pods | FS-3 | NA |
| | 12 - NOT SAMPLED | Plaster - on wallboard and metal mesh at corners - ASSUMED | NA | NA |
| 218 | 13-BM-A | Brick mortar - CMU block | FS-2 | NA |
| 219 | 13-BM-B | Brick mortar - CMU block | FS-2 | NA |
| 220 | 13-BM-C | Brick mortar - CMU block | FS-2 | NA |
| 221 | 14-PI-A | Pipe insulation - paper wrapped yellow fiberglass | FS-2 | NA |
| 222 | 14-PI-B | Pipe insulation - paper wrapped yellow fiberglass | FS-2 | NA |
| 223 | 14-PI-C | Pipe insulation - paper wrapped yellow fiberglass | FS-2 | NA |
| 224 | 15-PI-A | Pipe insulation - canvas wrapped beige fiberglass | FS-2 | NA |
| 225 | 15-PI-B | Pipe insulation - canvas wrapped beige fiberglass | FS-24 | NA |
| 226 | 15-PI-C | Pipe insulation - canvas wrapped beige fiberglass | FS-44 | NA |

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**Bulk Asbestos
 Chain of Custody**

ETL Project #: **253908**

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

| Lab ID | Sample ID | Material Description | Sample Location | Quantity |
|---------|------------------|---|-----------------|----------|
| 1441227 | 16-PF-A | Pipe fitting - canvas wrapped mudded fitting | FS-2 | NA |
| 228 | 16-PF-B | Pipe fitting - canvas wrapped mudded fitting | FS-2 | NA |
| 229 | 16-PF-C | Pipe fitting - canvas wrapped mudded fitting | FS-2 | NA |
| 230 | 16-PF-D | Pipe fitting - canvas wrapped mudded fitting | FS-5 | NA |
| 231 | 16-PF-E | Pipe fitting - canvas wrapped mudded fitting | FS-19 | NA |
| 232 | 16-PF-F | Pipe fitting - canvas wrapped mudded fitting | FS-24 | NA |
| 233 | 16-PF-G | Pipe fitting - canvas wrapped mudded fitting | FS-34 | NA |
| 234 | 16-PF-H | Pipe fitting - canvas wrapped mudded fitting | FS-40 | NA |
| 235 | 17-IC-A | Interior caulk - grey, around sliding door frame | FS-3 | NA |
| 236 | 17-IC-B | Interior caulk - grey, around sliding door frame | FS-3 | NA |
| 237 | 17-IC-C | Interior caulk - grey, around sliding door frame | FS-3 | NA |
| 238 | 18-CT-A | Ceiling tile - 12" white with a rough textured pinhole and fissure pattern | FS-3 | NA |
| 239 | 18-CT-B | Ceiling tile - 12" white with a rough textured pinhole and fissure pattern | FS-3 | NA |
| 240 | 18-CT-C | Ceiling tile - 12" white with a rough textured pinhole and fissure pattern | FS-3 | NA |
| 241 | 19-CM-A | Carpet mastic - yellow mastic under green, blue, red, and beige wave pattern carpet | FS-40 | NA |
| 242 | 19-CM-B | Carpet mastic - yellow mastic under green, blue, red, and beige wave pattern carpet | FS-25 | NA |
| 243 | 19-CM-C | Carpet mastic - yellow mastic under green, blue, red, and beige wave pattern carpet | FS-33 | NA |
| | 20 - NOT SAMPLED | Textured plaster - swirl and bumpy texture on walls and ceiling | NA | NA |
| 244 | 21-CB-A | Cove base - 4" black with adhesive | FS-40 | NA |
| 245 | 21-CB-B | Cove base - 4" black with adhesive | FS-25 | NA |
| 246 | 21-CB-C | Cove base - 4" black with adhesive | FS-33 | NA |
| 247 | 22-IC-A | Interior caulk - beige, around perimeter of sink | FS-5 | NA |
| 248 | 22-IC-B | Interior caulk - beige, around perimeter of sink | FS-5 | NA |
| 249 | 22-IC-C | Interior caulk - beige, around perimeter of sink | FS-5 | NA |
| 250 | 23-GM-A | Ceramic tile, grout, mortar - 2" blue and green floor tile | FS-10 | NA |
| 251 | 23-GM-B | Ceramic tile, grout, mortar - 2" blue and green floor tile | FS-10 | NA |
| 252 | 23-GM-C | Ceramic tile, grout, mortar - 2" blue and green floor tile | FS-10 | NA |

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**Bulk Asbestos
 Chain of Custody**

ETL Project #: **253908**

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

| Lab ID | Sample ID | Material Description | Sample Location | Quantity |
|---------|------------------|--|-----------------|----------|
| 1441253 | 24-GM-A | Ceramic tile, grout, mortar - 4" beige wall tile | FS-5 | NA |
| 254 | 24-GM-B | Ceramic tile, grout, mortar - 4" beige wall tile | FS-12 | NA |
| 255 | 24-GM-C | Ceramic tile, grout, mortar - 4" beige wall tile | FS-43 | NA |
| 256 | 25-IC-A | Interior caulk - around shower perimeter | FS-5 | NA |
| 257 | 25-IC-B | Interior caulk - around shower perimeter | FS-26 | NA |
| 258 | 25-IC-C | Interior caulk - around shower perimeter | FS-37 | NA |
| 259 | 26-HS-A | Heat shield - black, in shower light fixture | FS-5 | NA |
| 260 | 26-HS-B | Heat shield - black, in shower light fixture | FS-16 | NA |
| 261 | 26-HS-C | Heat shield - black, in shower light fixture | FS-43 | NA |
| 262 | 27-GTM-A | Gasket material - paper, between mirror glass and metal trim | FS-5 | NA |
| 263 | 27-GTM-B | Gasket material - paper, between mirror glass and metal trim | FS-40 | NA |
| 264 | 27-GTM-C | Gasket material - paper, between mirror glass and metal trim | FS-43 | NA |
| 265 | 28-CPR-A | Corrugated paper - between mirror panel and metal panel | FS-5 | NA |
| 266 | 28-CPR-B | Corrugated paper - between mirror panel and metal panel | FS-40 | NA |
| 267 | 28-CPR-C | Corrugated paper - between mirror panel and metal panel | FS-43 | NA |
| | 29 - NOT SAMPLED | Window glaze - black - ASSUMED | NA | NA |
| 268 | 30-CA-A | Construction adhesive - dark beige, around shower door perimeter | FS-5 | NA |
| 269 | 30-CA-B | Construction adhesive - dark beige, around shower door perimeter | FS-26 | NA |
| 270 | 30-CA-C | Construction adhesive - dark beige, around shower door perimeter | FS-31 | NA |
| 271 | 31-CM-A | Carpet mastic - beige mastic under pink carpet | FS-11 | NA |
| 272 | 31-CM-B | Carpet mastic - beige mastic under pink carpet | FS-12 | NA |
| 273 | 31-CM-C | Carpet mastic - beige mastic under pink carpet | FS-36 | NA |
| 274 | 32-CM-A | Carpet mastic - under striped carpet squares, earthy colors | FS-15 | NA |
| 275 | 32-CM-B | Carpet mastic - under striped carpet squares, earthy colors | FS-27 | NA |
| 276 | 32-CM-C | Carpet mastic - under striped carpet squares, earthy colors | FS-30 | NA |
| 277 | 33-CB-A | Cove base - dark grey, with multiple layers of adhesive | FS-15 | NA |
| 278 | 33-CB-B | Cove base - dark grey, with multiple layers of adhesive | FS-22 | NA |
| 279 | 33-CB-C | Cove base - dark grey, with multiple layers of adhesive | FS-17 | NA |

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**Bulk Asbestos
 Chain of Custody**

ETL Project #: **253908**

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

| Lab ID | Sample ID | Material Description | Sample Location | Quantity |
|---------|------------------|--|-----------------|----------|
| 1441280 | 34-MA-A | Mastic - black mastic from former floor tile, under carpet | FS-17 | NA |
| 281 | 34-MA-B | Mastic - black mastic from former floor tile, under carpet | FS-18 | NA |
| 282 | 34-MA-C | Mastic - black mastic from former floor tile, under carpet | FS-20 | NA |
| | 35 - NOT SAMPLED | Floor tile - 20" green tile - ASSUMED | NA | NA |
| | 36 - NOT SAMPLED | Stair tread - green tread - ASSUMED | NA | NA |
| | 37 - NOT SAMPLED | Brick mortar - red brick - ASSUMED | NA | NA |
| | 38 - NOT SAMPLED | Window glaze - white - ASSUMED | NA | NA |
| | 39 - NOT SAMPLED | Ceramic tile, grout, mortar - 1" brown floor tile - ASSUMED | NA | NA |
| | 40 - NOT SAMPLED | Ceramic tile, grout, mortar - 4" peach wall tile - ASSUMED | NA | NA |
| 283 | 41-HM-A | Hanger mud - white mud around pipe insulation at hanging hardware | FS-24 | NA |
| 284 | 41-HM-B | Hanger mud - white mud around pipe insulation at hanging hardware | FS-24 | NA |
| 285 | 41-HM-C | Hanger mud - white mud around pipe insulation at hanging hardware | FS-24 | NA |
| 286 | 42-CM-A | Carpet mastic - beige mastic under green, beige, and black speckled carpet | FS-38 | NA |
| 287 | 42-CM-B | Carpet mastic - beige mastic under green, beige, and black speckled carpet | FS-39 | NA |
| 288 | 42-CM-C | Carpet mastic - beige mastic under green, beige, and black speckled carpet | FS-41 | NA |
| | 43 - NOT SAMPLED | Mastic - dark grey, on wall - ASSUMED | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |
| | NA | NA | NA | NA |



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To: Atlas - Novi
46555 Humboldt Dr. Suite 100
Novi, Michigan 48377

ETL Job: 254637
Client Project: N/A
Report Date: 2/2/2023

Attention: Robert Smith
Project Location: Michigan State University
Owen Hall, West Wing, 1st Level

| Lab Sample Number | Client Sample Number | Sample Type | Completed |
|-------------------|----------------------|-------------|------------|
| 1452059 | 29-WG-A | Asbestos | 02/02/2023 |
| 1452060 | 29-WG-B | Asbestos | 02/02/2023 |
| 1452061 | 29-WG-C | Asbestos | 02/02/2023 |
| 1452062 | 38-WG-A | Asbestos | 02/02/2023 |
| 1452063 | 38-WG-B | Asbestos | 02/02/2023 |
| 1452064 | 38-WG-C | Asbestos | 02/02/2023 |

Reviewed by: 
Emily Nowacki

Summary

| Method | Sample | Layer | Mastic |
|--------|--------|-------|--------|
| PLM | 6 | | |

Polarized Light Microscopy Asbestos Analysis Report

To : Atlas - Novi
 46555 Humboldt Dr. Suite 100
 Novi, Michigan 48377

ETL Job : 254637
Client Project : N/A
Date Collected : 01/30/2023
Date Received : 02/01/2023

Location : Owen Hall, West Wing, 1st Level
 Michigan State University

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|---|--------------|------------------------------------|------------------|---------------|-------------------|
| 1452059 29-WG-A | Window Glaze | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Analyst: Dave Cousino Date Analyzed : 02/02/2023 | | | | | |
| 1452060 29-WG-B | Window Glaze | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Analyst: Dave Cousino Date Analyzed : 02/02/2023 | | | | | |
| 1452061 29-WG-C | Window Glaze | Gray Non-Fibrous Homogenous | PLM 1% Cellulose | PLM 99% Other | PLM None Detected |
| Analyst: Dave Cousino Date Analyzed : 02/02/2023 | | | | | |
| 1452062 38-WG-A | Window Glaze | White Non-Fibrous Homogenous | PLM 5% Cellulose | PLM 95% Other | PLM None Detected |
| Analyst: Dave Cousino Date Analyzed : 02/02/2023 | | | | | |
| 1452063 38-WG-B | Window Glaze | White Non-Fibrous Homogenous | PLM 5% Cellulose | PLM 95% Other | PLM None Detected |
| Analyst: Dave Cousino Date Analyzed : 02/02/2023 | | | | | |
| 1452064 38-WG-C | Window Glaze | White Non-Fibrous Homogenous | PLM 5% Cellulose | PLM 95% Other | PLM None Detected |
| Analyst: Dave Cousino Date Analyzed : 02/02/2023 | | | | | |

ETL, Inc. maintains liability limited to cost of analysis. This report relates only to the samples reported and may not be reproduced without written approval by ETL, Inc. Test Method EPA 600/R-93-116 & EPA 600/M4-82/020 or NYSDOH-ELAP item 198.1 and/or 198.6 was used to analyze all samples. Matrix interference and/or resolution limits (i.e. detecting asbestos in non-friable organically bound materials) may yield false results in certain circumstances. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing. Interpretation and use of test results are the responsibility of the client. ETL, Inc. is not responsible for the accuracy of the results when requested to physically separate and analyze layered samples. Any PLM results below 10% should be re-analyzed using the EPA recommended Point Count method. Any material that has greater than 1% asbestos content is considered to be an Asbestos Containing Material (ACM). These materials are regulated by both OSHA and the EPA and must be treated accordingly. Results are related to only to samples that were tested. An estimate of uncertainty can be provided at the client's request.


Polarized Light Microscopy Asbestos Analysis Report

To : Atlas - Novi
 46555 Humboldt Dr. Suite 100
 Novi, Michigan 48377

Location : Owen Hall, West Wing, 1st Level
 Michigan State University

ETL Job : 254637
Client Project : N/A
Date Collected : 01/30/2023
Date Received : 02/01/2023

| Sample | Description | Appearance | % Fibrous | % Non-Fibrous | % Asbestos |
|--------|-------------|------------|-----------|---------------|------------|
|--------|-------------|------------|-----------|---------------|------------|


 Lab Supervisor/Other Signatory

Analyst:


 Dave Cousino

400 Point Count Results by EPA 600/R-93/116 PLM (denoted by "PC")
 Item 198.1: PLM Methods for Identifying and Quantitating Asbestos in Bulk Samples
 Item 198.6: PLM Methods for Identifying and Quantitating Asbestos in Non-Friable Organically Bound Bulk Samples
 EPA 600/R-93/116: Method for Determination of Asbestos in Bulk Building Materials
 EPA 600/M4-82-020: Interim Method for Determination of Asbestos in Bulk Insulation Samples
 A % Asbestos result of "Trace" indicates that the analyzed material was found to contain less than 1% asbestos and would not be considered an Asbestos Containing Material (ACM).

ETL, Inc. maintains liability limited to cost of analysis. This report relates only to the samples reported and may not be reproduced without written approval by ETL, Inc. Test Method EPA 600/R-93-116 & EPA 600/M4-82/020 or NYSDOH-ELAP item 198.1 and/or 198.6 was used to analyze all samples. Matrix interference and/or resolution limits (i.e. detecting asbestos in non-friable organically bound materials) may yield false results in certain circumstances. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing. Interpretation and use of test results are the responsibility of the client. ETL, Inc. is not responsible for the accuracy of the results when requested to physically separate and analyze layered samples. Any PLM results below 10% should be re-analyzed using the EPA recommended Point Count method. Any material that has greater than 1% asbestos content is considered to be an Asbestos Containing Material (ACM). These materials are regulated by both OSHA and the EPA and must be treated accordingly. Results are related to only to samples that were tested. An estimate of uncertainty can be provided at the client's request.



**Bulk Asbestos
 Chain of Custody**

ETL Project #: 254637

| | | | | |
|-------------------|-----------------------------|--|----------------------------|---------------------------------|
| Client: | Atlas Technical Consultants | Contact: Rob Smith | Project Location/name: | MICHIGAN STATE UNIVERSITY, OWEN |
| | Address: | 46555 Humboldt Dr. Ste. 100 Novi, MI 48377 | | Phone: 248-669-5140 |
| Fax: 248-669-5147 | | Date Sampled: 1/30/2023 | | |
| E-mail: | | | HALL, WEST WING, 1ST LEVEL | |

Turnaround Time (TAT): RUSH Same Day 24 hr 48 hr Standard (3-5 days) Other _____

PLM Instructions
 (Check all that apply)

| | |
|--|--|
| <input type="checkbox"/> PLM EPA600/R-93/116, 1993 (Standard method) | <input checked="" type="checkbox"/> Stop at 1st Positive - |
| Point Counting: <input type="checkbox"/> 400 Points* <input type="checkbox"/> NYSDOH ELAP 198.1, 2002* | Clearly mark Homogenous Group |
| <input type="checkbox"/> Gravimetric Reduction* <input type="checkbox"/> NYSDOH ELAP 198.6, 2010* | |
| <input type="checkbox"/> PLM Non-Building Material (Dust, Wipe, Tape) | <input type="checkbox"/> Soil or Vermiculite Analysis* |

* Additional charge and turnaround may be required

| Lab ID | Sample ID | Material Description | Sample Location | Quantity |
|---------|-----------|----------------------|-----------------|----------|
| 1452059 | 29-WG-A | Window Glaze - Gray | W116 | |
| 060 | 29-WG-B | Window Glaze - Gray | W117 | |
| 061 | 29-WG-C | Window Glaze - Gray | W135 | |
| 062 | 38-WG-A | Window Glaze - White | Stairwell W2 | |
| 063 | 38-WG-B | Window Glaze - White | Stairwell W2 | |
| 064 | 38-WG-C | Window Glaze - White | Stairwell W2 | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| | | Date | Time |
|--|------------------|-----------|-------------|
| Relinquished (Name/Organization): | Ryan Rae / Atlas | 1/30/2023 | 1500 am/pm |
| Received (Name/ETL): | Emily N. L. | 2/1/23 | 2:30 am/pm |
| Sample Login (Name/ETL): | Emily N. L. | 2/2/23 | 8:00 am/pm |
| Stereoscopic/Sample Analysis (Name/ETL): | David Cassano | 2/2/23 | 10:00 am/pm |
| Results (Name/ETL): | David Cassano | 2/2/23 | 10:00 am/pm |
| QA/QC Review (Name/ETL): | JK | 2-2-23 | 1050 am/pm |

| | |
|---|---------|
| Special Instructions: <ul style="list-style-type: none"> • 1st Positive Stop; • Composite all drywall/joint compound samples if any layer of system is greater than 1% asbestos; • Point Count ALL PLASTER samples Trace to 3% asbestos content • Point Count ALL SAMPLES Trace to 1% asbestos content | Remarks |
|---|---------|

**IN ORDER TO ENSURE RESULTS BY SPECIFIED TAT, THE LAB MUST BE EMAILED/CALLED WITH THE QUANTITY OF SAMPLES TO BE SHIPPED OR DROPPED OFF

APPENDIX IV
QUALITY ASSURANCE DOCUMENTATION

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 201028-0

Environmental Testing Laboratories, Inc.
Romulus, MI

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

Asbestos Fiber Analysis

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

2022-04-01 through 2023-03-31

Effective Dates



Dana S. Haman
For the National Voluntary Laboratory Accreditation Program

MICHIGAN DEPARTMENT OF
LABOR AND ECONOMIC OPPORTUNITY

(<http://michigan.gov/miosha>)

Individual Profile for DELODDER, ANDREW H.

Name and Address

Name

DELODDER, ANDREW H.

Address

5869 LAKE MICHIGAN DRIVE
ALLENDALE, MI 49401

License Information

Accreditation Type: Contractor/Supervisor

ID#: A48677

Status: Apprvd - Full

Expiration Date: 11/28/2023

Training Expiration Date: 6/24/2023


Accreditation Type: Inspector

ID#: A48677

Status: Apprvd - Full

Expiration Date: 1/30/2024

Training Expiration Date: 11/18/2023

 [New Search \(/Individual/IndividualSearch\)](/Individual/IndividualSearch)

[Back to Top](#)







[MI.gov \(http://www.michigan.gov\)](http://www.michigan.gov)







[Asbestos Program - Verify and Search \(/\)](#)





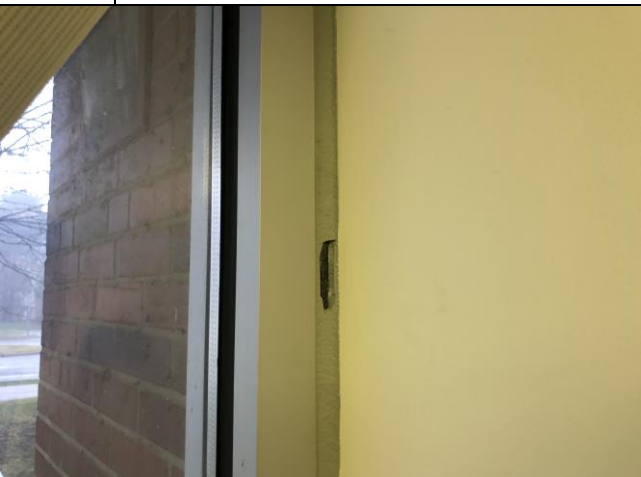
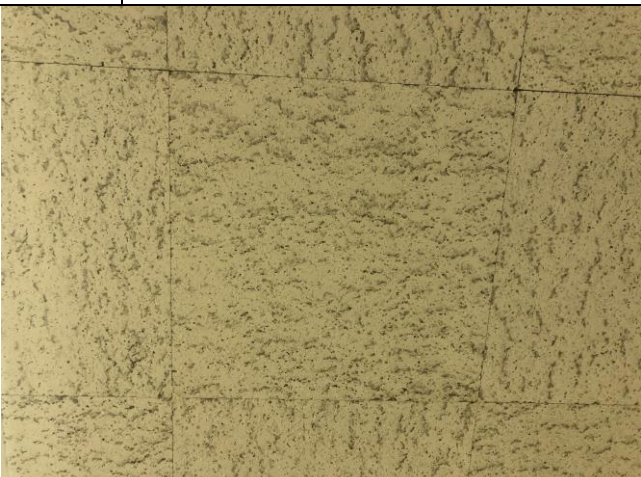
[Asbestos Program \(https://www.michigan.gov/asbestos\)](https://www.michigan.gov/asbestos)

[Policies \(http://www.michigan.gov/policies\)](http://www.michigan.gov/policies)

**APPENDIX V
PHOTOGRAPHS**







| | | | |
|---|---|--|---|
|  | |  | |
| View Of: | HA-1: Fire door - wood door | View Of: | HA-2: Fire door - metal door |
| Asbestos % | Assumed | Asbestos % | Assumed |
|  | |  | |
| View Of: | HA-3: Concrete chip - poured concrete pad foundation | View Of: | HA-4: Floor tile - 9" black tile with white streaks, and mastic |
| Asbestos % | Non Detect | Asbestos % | Assumed |
|  | |  | |
| View Of: | HA-5: Carpet mastic - yellow mastic under blue carpet with multi-colored specks | View Of: | HA-6: Cove base - 4" burgundy composite with adhesive |
| Asbestos % | Non Detect | Asbestos % | Non Detect |

| | | | |
|--|---|--|---|
|  | |  | |
| View Of: | HA-7: Wall sheeting - canvas wall covering with criss-cross trowelled texture | View Of: | HA-8: Interior caulk - red, in wall/ceiling penetrations and voids |
| Asbestos % | Non Detect | Asbestos % | Non Detect |
|  | |  | |
| View Of: | HA-9: Ceiling tile - 12" white pinhole and fissure | View Of: | HA-10: Glue pods - light grey glue adhering ceiling tiles t concrete deck |
| Asbestos % | Non Detect | Asbestos % | Non Detect |
|  | |  | |
| View Of: | HA-11: Glue pods - light brown | View Of: | HA-12: Plaster - on wallboard and metal mesh at corners |
| Asbestos % | Non Detect | Asbestos % | Non Detect |

| | | | |
|---|--|--|---|
|  | |  | |
| View Of: | HA-13: Brick mortar - CMU block | View Of: | HA-14: Pipe insulation - paper wrapped yellow fiberglass |
| Asbestos % | Non Detect | Asbestos % | Non Detect |
|  | |  | |
| View Of: | HA-15: Pipe insulation - canvas wrapped beige fiberglass | View Of: | HA-16: Pipe fitting - canvas wrapped mudded fitting |
| Asbestos % | Non Detect | Asbestos % | PLM 10% Chrysotile |
|  | |  | |
| View Of: | HA-17: Interior caulk - grey, around sliding door frame | View Of: | HA-18: Ceiling tile - 12" white with a rough textured pinhole and fissure pattern |
| Asbestos % | Non Detect | Asbestos % | Non Detect |

| | | | |
|---|--|--|--|
|  | |  | |
| View Of: | HA-19: Carpet mastic - yellow mastic under green, blue, red, and beige wave pattern carpet | View Of: | HA-20: Textured plaster - swirl and bumpy texture on walls and ceiling |
| Asbestos % | Non Detect | Asbestos % | Non Detect |
|  | |  | |
| View Of: | HA-21: Cove base - 4" black with adhesive | View Of: | HA-22: Interior caulk - beige, around perimeter of sink |
| Asbestos % | Non Detect | Asbestos % | PLM 2% Chrysotile |
|  | |  | |
| View Of: | HA-23: Ceramic tile, grout, mortar - 2" blue and green floor tile | View Of: | HA-24: Ceramic tile, grout, mortar - 4" beige wall tile |
| Asbestos % | Non Detect | Asbestos % | Non Detect |

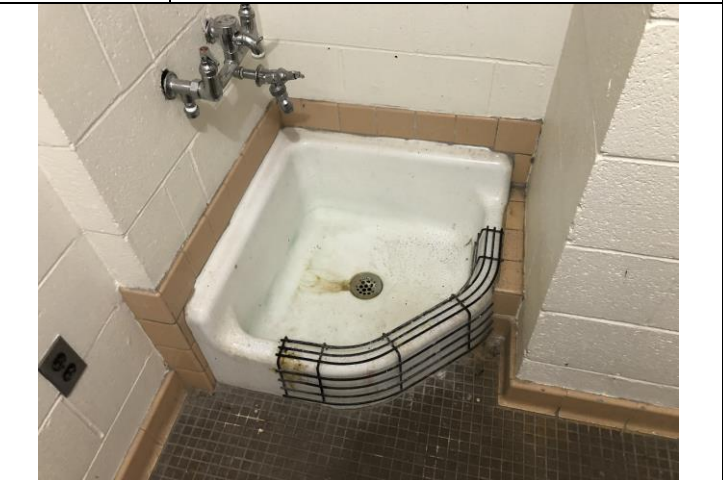
| | | | |
|---|---|--|---|
|  | |  | |
| View Of: | HA-25: Interior caulk - around shower perimeter | View Of: | HA-26: Heat shield - black, in shower light fixture |
| Asbestos % | Non Detect | Asbestos % | Non Detect |
|  | |  | |
| View Of: | HA-27: Gasket material - paper, between mirror glass and metal trim | View Of: | HA-28: Corrugated paper - between mirror panel and metal panel |
| Asbestos % | Non Detect | Asbestos % | Non Detect |
|  | |  | |
| View Of: | HA-29: Window glaze - black | View Of: | HA-30: Construction adhesive - dark beige, around shower door perimeter |
| Asbestos % | Non Detect | Asbestos % | PLM 3% Chrysotile |

| | | | |
|---|--|--|--|
|  | |  | |
| View Of: | HA-31: Carpet mastic - beige mastic under pink carpet | View Of: | HA-32: Carpet mastic - under striped carpet squares, earthy colors |
| Asbestos % | Non Detect | Asbestos % | Non Detect |
|  | |  | |
| View Of: | HA-33: Cove base - dark grey, with multiple layers of adhesive | View Of: | HA-34: Mastic - black mastic from former floor tile, under carpet |
| Asbestos % | Non Detect | Asbestos % | Non Detect |
|  | |  | |
| View Of: | HA-35: Floor tile - 20" green tile | View Of: | HA-36: Stair tread - green tread |
| Asbestos % | Non Detect | Asbestos % | Non Detect |



| | |
|-------------------|---------------------------------|
| View Of: | HA-37: Brick mortar - red brick |
| Asbestos % | Assumed |

| | |
|-------------------|-----------------------------|
| View Of: | HA-38: Window glaze - white |
| Asbestos % | Non Detect |



| | |
|-------------------|--|
| View Of: | HA-39: Ceramic tile, grout, mortar - 1" brown floor tile |
| Asbestos % | Assumed |

| | |
|-------------------|---|
| View Of: | HA-40: Ceramic tile, grout, mortar - 4" peach wall tile |
| Asbestos % | Assumed |



| | |
|-------------------|--|
| View Of: | HA-41: Hanger mud - white mud around pipe insulation at hanging hardware |
| Asbestos % | PLM 5% Chrysotile |

| | |
|-------------------|---|
| View Of: | HA-42: Carpet mastic - beige mastic under green, beige, and black speckled carpet |
| Asbestos % | Non Detect |

| | | | |
|---|------------------------------------|-----------------------|-----------------------------|
| Behind HVAC louvers – no picture available. | | no picture available. | |
| View Of: | HA-43: Mastic - dark grey, on wall | View Of: | Spray Applied Fire Proofing |
| Asbestos % | Assumed | Asbestos % | Assumed |

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY OF WORK

A. Work Under This Contract

1. All work associated with the conversion of office space into student rooms on the first floor of Owen Graduate Hall – West. Minor plan revisions will be made with finish upgrades to the bedrooms, bathrooms, and corridor. Fire alarm will be updated for this wing. Electrical and mechanical revisions will be made with new piping installed in concealed spaces between the lower level and first floor.
2. This Contract encompasses the furnishing of all labor, materials, services, equipment, and insurance to complete the following as shown on drawing and specified herein:
3. Any premium time necessary to complete this project as scheduled, shall be included in the Base Bid.
4. All pertinent requirements of the Invitation to Bidders, Instructions to Bidders, and General Conditions shall form a part of these specifications and the Contractor shall consult them in detail for instructions pertaining to the work in the following divisions.

B. Work Performed Under Separate Contracts

1. The following will be provided by the Owner or by others under separate contracts:
 - a. Abatement of asbestos containing materials (ACM) – refer to ACM report.
 - b. Temporary and final keying (see Section 087100)
 - c. Departmental possessions - furniture, books, personal items, etc., shall be relocated by the Department or University as required.

C. Pre-Ordered Products

1. The Contractor shall assume full responsibility for all pre-ordered products after their arrival at MSU. This includes transportation, handling, storage, start-up, warranty services, and installation in accordance with the General Conditions unless otherwise specified.

D. Work Sequence

1. Start date for construction: Monday, March 6, 2023.

2. The Substantial construction completion date for this project is as specified in the Advertisement for Bids.

1.2 WORK RESTRICTIONS

A. Access Routes

1. All materials and equipment (new and demolition), including mechanical and electrical, shall be transported through a building via the designated building receiving area (usually the loading dock), and through main corridor to rooms or areas. Alternate routes may be used only with the approval of the Project Representative.

B. Owner Occupancy

1. Unless otherwise stated, University buildings will continue to function and remain occupied during the construction process.
2. On every project involving new construction, additions or alterations to existing facilities, M.S.U. requires the ability of a person with physical disabilities to independently get to, enter, and use the site, facility, building or element. In no way shall a site, building or facility be restricted to individuals with disabilities, due to alterations or construction, which would normally be made accessible to individuals with no disabilities. Alternate routes for all new and alterations of existing facilities shall incorporate the latest federal, state and local barrier free standards and include temporary access accommodations for individuals with disabilities.

C. Use of Site

1. There shall be a pre-construction site walk-thru with the Project Representative to clarify and discuss limitations and concerns prior to construction.
2. Construction fence
 - a. A construction fence shall be placed around the construction site as shown on the drawings and as approved by the Project Representative.
 - b. The Contractor is responsible for installing and maintaining the construction fence and gates to restrict access by the public to the area under construction. The Contractor may be required to reposition the fence and/or gate(s) during the course of construction to accommodate the construction activities in order to minimize the inconvenience to the public.
 - c. The fence shall be constructed of chain link fabric with a minimum height of 6', with metal or wood posts at not to exceed 8' spacing. Fence fabric shall be supported by either a top bar or tension cable. Gates (where specified) will be constructed of a suitable metal frame with chain link fabric with a height of not less than 6'. This fence shall be installed before work commences.

- d. Metal signs reading "Construction Area - Keep Out" must be attached to the fence at not more than 20' spacing and to the gate(s).
- e. Where any fence crosses an existing walk, drive, or road, a lighted MDOT Type 1 barricade or larger shall be attached to the inside of the fence facing on-coming pedestrian and/or vehicular traffic.
- f. No construction work, parking, storage of materials or related activities shall occur beyond this boundary fencing.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 012000 - PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 PROPOSAL QUOTATION REQUIREMENTS

- A. Projects to be bid will be quoted as required by the front-end documents on the specification.
 - a. Add Alternate No. 1: Provide and install all new piping between the sub-basement and underside of first floor. Installation to include demolition work in Corridor HW1 as well as patching, painting, and installation of access doors.

1.2 CONTRACT BREAKDOWNS

- A. Within twenty-four (24) hours after receipt of Bids, the apparent Low Bidder shall submit to the Architect/Engineer, the following:
 - 1. A Schedule of Values (SOV), indicating the cost of each specified Division and/or Major Subdivision of the Bid. The approved SOV will be used as the basis for estimating partial payments to the Contractor when allowed per the front-end documents.
 - 2. All contracts shall assign a minimum of 1% of the contract value for final completion and project closeout. This item must be identified as a separate line item labeled *Closeout* on the SOV. Exceptions must be approved by the Construction Superintendent.
 - 3. Due to changes to Generally Accepted Accounting Practices, environmental remediation must be separately reported in the Owner's financial statements. Accordingly, all contracts shall carry remediation costs in separate lines clearly marked *remediation*. These titles should not be used in other line descriptions.
 - 4. Construction Management contracts shall carry separate detail lines for at least the following lines:
 - i. Preconstruction Services
 - ii. Construction phase staffing
 - iii. General conditions
 - iv. Bonds and Insurance. Note that subcontractor bonds are not required to be separately listed.
 - v. Fee
 - vi. Closeout
 - 2. Identify a Subcontractor for each Division and/or Major Subdivision for the Owner's approval. Once approved, no Subcontractors will be changed without the Owner's written consent. The List of Subcontractors will have indicated the MBE/WBE Contractors and their percentages of the Contract Price as specified in the "Cover Letter" or "Advertisement for Bids" of this project.

3. A list of representatives authorized to perform Unifier functions on behalf of the Contractor using the [Unifier System - Vendor Information](http://ipf.msu.edu/index.cfm/capital-project-procedures/documents/unifier-system-vendor-information/) available at <http://ipf.msu.edu/index.cfm/capital-project-procedures/documents/unifier-system-vendor-information/>.

1.3 CONTRACT MODIFICATION PROCEDURES

A. Change Management Quotation Requirements

1. Quotations for changes in the Contract will be submitted via Unifier when requested, as outlined in Section 012000-1.5.B, Change Management Procedures. This section will not prohibit the Project Representative from requesting and receiving verbal quotations. It is intended that mutual cooperation will keep any changes to an absolute minimum. The Contractor shall promptly document any verbal request by initiating a Change Management or Change Request record in Unifier. The Contractor shall not engage in added work without proper authorization by the Owner. Any added work the Contractor engages in without authorization shall be at the Contractor's risk. In no event shall the failure of the Construction Representative to initiate a change constitute authorization for the Contractor to proceed with work.
2. The [Change Order Quotation Format Form](http://procedures.ipf.msu.edu/index.cfm/capital-project-delivery-procedures/) is available on the MSU [Capital Project Delivery Procedures](http://procedures.ipf.msu.edu/index.cfm/capital-project-delivery-procedures/) website (<http://procedures.ipf.msu.edu/index.cfm/capital-project-delivery-procedures/>). This Form shall be forwarded to each required Subcontractor, and is recommended as an outline of the information required by this Contract.
3. The Contractor will submit quotations through Unifier, including detailed breakdowns. Upon request, originals of any documents shall be provided to the Owner. The Project Representative will receive quotations from the Contractor only. Subcontractors will submit quotations through the Contractor. All Contractors will submit quotations with information and back-up data as indicated on the quotation form.

B. Change Management Procedures

1. Change Orders shall be issued as required to alter the Contract, (i.e. change the work scope, materials, dates, etc.), in accordance with the General Conditions of the Contract, and the following procedure:
 - a. The Contractor or the Project Representative shall initiate a Change Request in the Unifier Project Management System. Each Change Request will consist of only one change item of work.
 - b. Items brought up by the Department or Contractor shall be reviewed first with the Project Representative.
 - c. The Architect/Engineer will review the Change Request, and with the Project Representative, will determine the need for an item to be changed in the Contract by Change Order.

- d. If the Change Request is approved, the Contractor will receive a request through Unifier to proceed with the work and/or provide pricing, as applicable. Provide a quotation for the item requiring change, unless the Change Request is submitted as a lump sum with a quotation attached.
- e. The Contractor will submit a quotation for each Change Request item in accordance with the applicable Unifier business process. Overhead and profit shall be applied consistent with the General Conditions.
- f. The Project Representative and Architect/Engineer will evaluate the quotations and accept or reject each item quoted. A Change Order will be created within the Unifier system and will be issued through the MSU Purchasing Department to change the contract amount if required.
- g. The Construction Supervisor or Director of Planning, Design and Construction has approval authority for the Contract Change.

1.4 CONTRACT PAYMENT PROCEDURES

A. Payment application requirements

- 1. Payment applications shall be submitted in Unifier, consistent with the contract documents.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 013000 - ADMINISTRATIVE REQUIREMENTS


PART 1 - GENERAL

1.1 PROJECT MANAGEMENT AND COORDINATION

A. Project Meetings

1. Project meetings may be called as deemed necessary by the Project Manager.

B. Project Scope Documentation

1. The Contractor shall use  PlanGrid for coordination of changes in the field, punch list items, and potential use for plan review comments.

C. Project Coordination

1. The Contractor is ultimately responsible for coordination to complete all work shown on drawings and specified herein independent of the location of the work on drawings and within the specifications. The arrangement of work within the specification into Divisions and Sections shall be considered as given for convenience of reference only and shall not be held to conform to jurisdictional rules which may prevail in any particular trade. It shall be the responsibility of the Contractor to so arrange or group items of work under a particular trade to conform to the prevailing customs of that trade and best interest of the Owner. Specific items of work will be performed by specific subcontractors or workmen when so specified herein or subsequently deemed necessary by the Project Representative to produce competent results.
2. The Contractor shall lay out the work and be responsible for all lines and measurements of the work. Before ordering material or executing work the Contractor shall obtain field measurements and prepare the work to fit conditions properly.
3. The Contractor will be held responsible for any error resulting from his/her failure to verify the figures shown on the drawing before laying out the work.
4. No extra charge will be allowed on account of slight variations between field dimensions and dimensions given on the drawings.

D. Mechanical and Electrical Coordination

1. Connection to Existing Equipment
 - a. The Contractor shall make arrangements with Planning, Design and Construction, through the Project Representative, before connecting to existing facilities. Unless otherwise noted, if interruption of service is required it shall be done at the convenience of the Owner.

1.2 CONSTRUCTION PROGRESS DOCUMENTATION

A. Construction Schedule Development/Coordination Responsibilities.

1. The Critical Path Method (CPM) will be used to plan, schedule, execute and report status of work under this contract. It shall include and properly coordinate dates for performance of all divisions for each major portion of the Work, and including completion of off-site requirements and tasks if request by Project Representative.
 - a. Within fourteen (14) calendar days of the Letter of Intent or contract award, the Contractor shall develop a proposed Baseline schedule for the Work, and submit it to each subcontractor to incorporate their own work.
 - b. All subcontractors, both direct and indirect, shall, within seven (7) calendar days of receipt of the Contractor's Schedule, submit revisions, comments and feedback to the Contractors, which shall be incorporated into the proposed schedule.
 - c. Upon receipt of the schedule from the Subcontractors, the Contractor will incorporate Subcontractors information into the Baseline Construction Schedule with appropriate logic ties and Contract Milestones, and distribute to the Architect/Engineer and Owner within seven (7) calendar days. Thus the Contractor Schedule development will be completed within twenty-eight (28) calendar days from Letter of Intent or Contract, awaiting Owner approval.
 - d. After project schedule has been accepted by the Owner the Contractor within five days (5 days) schedule a meeting with all subcontractors to review and encourage schedule compliance.
2. **All Subcontractors shall cooperate with the General Contractor to prepare and maintain the Construction Schedule, which shall include, without limitation, the following information at the General Contractor request.**
 - a. Shop Drawing review and approval, product procurement, fabrication, shop inspection, and delivery dates including lead times. Note: A/E shall be given 14 days upon receipt of submittal to review and return submittal.
 - b. Each phase of the Work, including the Punch List, Project Closeout requirements, Contract Completion and Occupancy;
 - c. Milestone dates that are required by the Contract Documents and Progress Milestones. Milestones should typically be based on the critical path and not exceed one (1) month between milestones.
 - d. The critical path of the Work
 - e. Planned disruptions and shutdowns due to other operations, facilities and functions, if any.

3. Upon receipt of the proposed Construction Schedule, the Architect/Engineer (A/E) and Owner (or other designee of the Owner), shall review the Construction Schedule and submit a copy of the Construction Schedule with comments to the Contractor within seven (7) calendar days. Within five (5) calendar days of review of comments from the Owner, all requested changes shall be incorporated in to the baseline Construction Schedule and a printout and electronic copy shall be provided to the Owner. Thus, the Contractor Schedule development with Owner review and Contractor modifications/changes shall not exceed forty (40) calendar days from the Letter of Intent.
4. **No progress payments will be made to the Contractor without a Baseline Construction Schedule approved by the Owner (or other designee of the Owner).**
5. Unless otherwise specified in the Contract Documents or waived in writing by the Owner, the Contractor shall provide **monthly progress reports, at a minimum**, to the Architect/Engineer and the Owner, which shall include recommendations for adjusting the construction schedule to meet Milestone Completion dates and contract completion dates.
6. An updated construction schedule shall be submitted each month to the Project Rep. The Project Rep shall review the submittal, provide comments as necessary. **No payment will be made without an updated construction schedule approved by the Project Representative.**
7. When it is apparent to the contractor and A/E that critical path activities, scheduled Milestone completion dates, or contract completion dates will not be met, the Contractor shall submit to the Owner for review and approval, a plan to avoid or minimize any delay. Such a plan may include, without limitation, increasing the Contractor's workforce; increasing the number of working hours per shift, shifts per workday, workdays per week, the amount of construction equipment, and rescheduling of activities, or any combination thereof; to achieve maximum practical concurrency of work efforts and eliminate the cause of such delay. The Contractor agrees that such actions as described in this paragraph or other action deemed necessary by the Contractor will be taken promptly and without additional cost to the Owner.
8. Any request for time extensions or damages due to delay will only be considered where it is proven by the Contractor, using acceptable scheduling techniques, that the project's contractual intermediate milestones or contract completion dates have been directly impacted by the alleged issue causing the delay. This does not preclude the Contractor's right to finish the Project early. It does explicitly establish the condition upon which the Contractor shall be entitled to request time extensions or delay damages.

B. Construction Schedule Technical Requirements

1. The Critical Path Method (CPM) shall be used to plan, schedule, execute and report the status of work under this contract. The CPM Construction Schedule shall be developed

utilizing a Scheduling Software approved by Owner. It shall include and properly coordinate dates for performance of all divisions for each major portions of the work, including completion of off-site requirements and tasks.

2. The objective of the CPM Construction Schedule is to define and plan the reasonable timing and sequencing of all work, from Letter of Intent or Notice to Proceed to Final Contract Completion (along with interim Milestone Completion dates required by the contract) without exceeding the Contract Time limits. At a minimum, CPM activities shall be used for defining the following:
 - a. Permitting
 - b. Submittal/procurement/approval process (including shop drawing preparation)
 - c. Material and equipment fabrication and delivery
 - d. Construction/Installation
 - e. Trade coordination
 - f. Shutdowns
 - g. Owner performed work and Owner-provided items
 - h. Work of Other Contractors (indirect) hired by the Owner
 - i. Governing Agencies inspections
 - j. Punch list
 - k. Commissioning
 - l. Clean-up and project close-out
Contract Completion/Occupancy
3. The Construction Schedule level of detail shall be broken down to the extent individual activities do not combine (a) Subcontractor work; (b) distinct divisions of work; (c) work in separate facilities or areas; or (d) rough-in and finish items of work. Construction/Installation activities shall not exceed duration of fifteen (15) workdays and Owner review/approval activities are to include a reasonable time for review depending on the size and complexity of the submittal.
4. Preparation of the "Baseline" Construction Schedule shall commence following the issuance of a Letter of Intent, and shall be submitted to the Architect/Engineer and Owner (or other designee of the Owner) within twenty-eight (28) calendar days of issuance of the Letter of Intent. The Architect/Engineer and Owner will review and provide comments as it relates to the schedule. The Construction Schedule must involve input from all major subcontractors and be signed by the Contractor and all Primes/Subcontractors indicating their approval in the accuracy of the Baseline Construction Schedule and/or Schedule Updates. Submittal and approval of the Baseline Construction Schedule and/or Monthly Schedule Updates are required prior to the corresponding progress payment being released.
5. The Contractor will utilize "Retained Logic" as the method of calculating the Construction Schedule and Updated Schedules, which will be computer generated and computer drawn.
6. The Construction Schedule requirement shall include but not be limited to (a) Baseline

Schedule; (b) Monthly schedule updates, (c) Weekly 2 week look-ahead schedules.

7. The Contractor shall provide the current updated Construction Schedule for review and discussion at each regular progress meeting. In addition, the Contractor shall prepare a two-week look-ahead schedule for distribution at the progress meetings. This information shall be derived directly from the current Construction Schedule. The two-week look-ahead schedule shall include all activities scheduled to commence, continue or complete in the upcoming two weeks.
8. Each monthly schedule submittal will consist of one electronic file containing current schedule files or back-up, narrative, reports and plots discussed later in this section. Each monthly schedule shall be submitted using the Unifier Transmittal process. Each schedule submittal shall be uniquely identified as to which revision and/or update and will incorporate any Owner schedule review comments from previous schedule submissions. The date of the data shall be within two (2) calendar days of the Schedule submittal date.
9. The Construction Schedule shall meet the following criteria:
 - a. Activity descriptions shall be clear and concise
 - b. Activities shall be coded with sufficient detail to identify the activity as to phase, type of work, responsibilities, area of work, interface with other contracts, and any other coding necessary to accurately describe or sort the work activity.
 - c. Activity durations shall be sufficiently short to accurately disseminate an item of work with the maximum installation activity not to exceed fifteen (15) workdays.
 - d. Architect/Engineer and Owner review and approval activities will allow for sufficient time depending on the size, quantity of and complexity of the submission(s) (14 calendar days minimum).
 - e. Logic ties shall be shown on graphics at the discretion of the Owner. Logic ties shall be accurate and reasonable with no regard to preferential logic that would sequester float for any one party. Logic ties will be reasonable to the point that a true critical path is identifiable from the beginning of the project (Letter of Intent) to the Final Completion milestone. Constraint dates are to be used at a minimum with a description for their basis if used. No open-ended activities shall be allowed.
 - f. The Construction Schedule shall allow for and depict: recognized national holidays, proposed number of workdays per week for each activity (calendar), adherence to specific restrictions, constraints and contract completion milestones (interim and final) stipulated in the contract documents and work of separate Contractors.
 - g. Contractually specified interim Completion Milestone dates shall be constrained to show negative float, if the early finish date of the last activity in that phase

falls after the interim Milestone Completion date.

10. For all major equipment and materials fabricated or supplied for this project, the Construction Schedule shall show a sequence of activities including:
 - a. Preparation of submittal shop drawings, samples and O&M instructions.
 - b. Review of shop drawings, samples and O&M instructions by the Architect/Engineer (allow reasonable time for review depending on size and complexity of the submittal, minimum 14 calendar days).
 - c. Shop fabrication and delivery
 - d. Erection or installation
 - e. Testing of equipment and materials
 - f. Required dates of completion
 - g. Instruction of operating personnel

11. Baseline Construction Schedule and Periodic Schedule Monthly Update submittals shall include the following information:
 - a. Report content:
 - 1) Activity number
 - 2) Activity description
 - 3) Activity durations in work days (not to exceed 15 workdays)
 - 4) Remaining durations in work days
 - 5) Early and late start dates (Actual dates when progressed)
 - 6) Early and late finish dates (Actual dates when progressed)
 - 7) Percent complete
 - 8) Total float
 - 9) Free float
 - b. An electronic file of the schedule files with all current schedule information.

12. If a Construction Schedule revision is required as determined by the Owner, Contractor or Architect/Engineer, the Contractor must include a complete schedule submittal with reports accompanied with a detailed narrative report describing the basis for any and all changes proposed by the Contractor. The Contractor cannot make significant revision(s) to the schedule without written approval by the Owner.

13. Schedule float is not for the exclusive use of any one party and should be shared for the projects benefit. The Contractor's work shall proceed to the early start dates and the Owner shall have the right to reserve and apportion float time according to the needs of the project.

14. If any of the Project Contract Milestones fall behind more than five (5) workdays, the Contractor is required to develop a Time Recovery Plan and Schedule, which shall be monitored weekly by the Contractor. The Contractor shall detail within the next Construction Schedule submittal narrative, the reorganization means and methods instituted in the schedule recovery plan to get back to the contract completion date(s). The recovery period should be achieved within the shortest reasonable time.

- a. If the recovery plan does not achieve its goal by the next pay request period, the Contractor will be required to develop another recovery plan until the Contract Completion Milestones are back on schedule.
 - b. If the recovery plan has sufficient regained compliance with the Project Milestone Dates, use of the Baseline Construction Schedule will be resumed.
15. Time Extensions/Adjustments will only be granted when the Contractor can accurately demonstrate through the use of the Construction Schedule and accepted scheduling techniques, the need for a time extension due to delays, change orders or impacts by others. Schedule fragments and/or critical path schedule analysis shall be developed and submitted with each change order or other request for time adjustment. Time extension requests shall be submitted within ten (10) days of the onset of the occurrence impacting the Construction Schedule. Failure to submit this information by the time stated above shall result in rejection of the request. Based primarily on information provided by the Contractor, the Owner will decide the extent of impact and respond within a reasonable time depending on the complexity of the analysis required.
- a. If the time extension request is approved, the impact period will then be incorporated into the Construction Schedule.
 - b. If the time extension request is rejected, no change to the project schedule will be permitted.
16. The Contractor shall coordinate its work with the Owner and other Subcontractors and shall cooperate with other Subcontractors by utilizing orderly progress toward completion in accordance with the work scheduled.

1.3 MILESTONE SCHEDULE REQUIREMENTS

- A. The following Milestone Schedule dates for the listed work are provided as part of the contract requirements.

| <u>MILESTONE ACTIVITY</u> | <u>START</u> | <u>COMPLETION</u> |
|---------------------------|-----------------------|-----------------------|
| Start of Construction | Monday, March 6, 2023 | |
| Substantial Completion | | Friday, July 28, 2023 |

1.4 SUBMITTALS

- A. Submittal Schedule
1. Concurrently with the development of the Contractor's Construction Schedule, the Contractor shall prepare a complete schedule of submittals. Submit the initial Submittal Schedule along with the Construction Schedule, at, or prior to, the Pre-Construction Conference.

- a. Coordinate the Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products, as well as the Contractor's Construction Schedule.
 - b. Prepare the schedule in chronological order. Provide the following information:
 - Scheduled date for the first submittal
 - Related section number or specification number
 - Submittal category (Shop Drawing, Product Data, Calculations, Test Results or Samples.
 - Name of the subcontractor
 - Scheduled date for resubmittal
 - Scheduled date for completion of the A/E's review
2. Distribution: Following the Owner's response to the initial submittal, print and distribute copies to the Project representative, A/E, Owner, subcontractors, suppliers and other parties required to comply with the submittal dates indicated. Keep copies at the Project Site at all times.
- a. When revisions are made, distribute to the same parties and post at the same locations. Delete parties for distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
3. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting, or as requested by the Project Representative.
- B. Submittals are required for, but are not limited to, each of the following. The Contractor should refer to each of the following referenced sections for additional requirements of each submittal. All submittals are to be processed electronically using Unifier.
1. GENERAL SUBMITTALS
Section 012000 for Contract Breakdowns
Section 013000 for Safety Documentation
Section 017000 for FADE Log
 2. AS-BUILT DRAWINGS
As-built Drawings are required as specified in Section 017000.
 3. CERTIFICATES OF INSPECTION
Certificates of Inspection are required as specified in Section 017000.

220500 for Plumbing Permits and Inspection
260500 for Electrical Permits and Inspection
220500 for Common Work Results for Plumbing
220529 for Hangers and Supports for Plumbing Piping and Equipment
230500 for Common Work Results for HVAC
260500 for Common Work Results for Electrical

280800 for Commissioning of Fire Alarm Systems

4. **OPERATION AND MAINTENANCE DATA**
Operation and maintenance data is required as specified in Section 017000.
5. **GUARANTEES**
Guarantees are required as specified in Section 017000.

Section 079200 for Joint Sealants
Section 088300 for Mirrors
Section 093400 for Waterproofing Membrane Tiling
Section 099600 for High Performance Coatings
6. **SAMPLES**
Samples are required as specified in Section 013000 for the following items:

Section 062023 for Interior Finish Carpentry
Section 079200 for Joint Sealants
Section 081416 Flush Wood Doors
Section 088300 for Mirrors
Section 093400 for Waterproofing Membrane Tiling
Section 096513 for Resilient Base
Section 096519 for Resilient Tile Flooring
Section 096800 for Carpeting
Section 099123 for Interior Painting
Section 101100 for Visual Display Surfaces
Section 102810 for Toilet and Bath Accessories
Section 123661.16 for Solid Surface Countertops
Section 123661.19 for Quartz Countertop
7. **SHOP DRAWINGS**
Shop drawings are required as specified in Section 013000 for the following items:

Section 035300 for Concrete Patching
Section 061053 for Miscellaneous Rough Carpentry
Section 062023 for Interior Finish Carpentry
Section 079200 for Joint Sealants
Section 081113 for Hollow Metal Frames
Section 081416 for Flush Wood Doors
Section 083113 for Access Doors and Frames
Section 087100 for Door Hardware
Section 088300 for Mirrors
Section 092613 for Gypsum Veneer Plastering
Section 093400 for Waterproofing Membrane Tiling
Section 096519 for Resilient Tile Flooring

Section 096800 for Carpeting
Section 099123 for Interior Painting
Section 099600 for High Performance Coatings
Section 10100 for Visual Display Surfaces
Section 102810 for Toilet and Bath Accessories
Section 104400 for Fire Protection Specialties
Section 122116 for Vertical Louver Blinds
Section 123661.16 for Solid Surface Countertops
Section 210500 for Common Work Results for Fire Suppression
Section 211313 for Wet-Pipe Sprinkler Systems
Section 220500 for Common Work Results for Plumbing
Section 220523 for General-Duty Valves for Plumbing
Section 220529 for Hangers and Supports for Plumbing Piping and Equipment
Section 220700 for Plumbing Insulation
Section 221116 for Domestic Water Piping
Section 221119 for Domestic Water Piping Specialties
Section 221316 for Sanitary Waste and Vent Piping
Section 221319 for Sanitary Waste Piping Specialties
Section 224000 for Plumbing Fixtures
Section 230500 for Common Work Results for HVAC
Section 230513 for Common Motor Requirements for HVAC Equipment
Section 230529 for Hangers and Supports for HVAC Piping and Equipment
Section 230800 for Commissioning of HVAC
Section 260500 for Common Work Results for Electrical
Section 260519 for Low-Voltage Electrical Power Conductors and Cables
Section 260526 for Grounding and Bonding for Electrical Systems
Section 260533 for Raceway and Boxes for Electrical Systems
Section 260923 for Lighting Control Devices
Section 262400 for Switchboards, Panelboards, and Control Centers
Section 262726 for Wiring Devices
Section 265100 for Interior Lighting
Section 265200 for Emergency Lighting
Section 2830100 for Fire Detection and Alarm

8. TEST AND BALANCE REPORTS

Section 035300 for Concrete Patching.

C. Shop Drawings and Samples

1. The Contractor shall review, stamp with their approval, and submit via the Unifier Submittal process to the Project Representative all Shop Drawings and Samples asked for in these specifications, or deemed necessary by the Architect/Engineer.
2. Work will not begin on any item requiring Shop Drawings or samples until the Contractor receives approval in writing from the Architect/Engineer. Any material or item, ordered or fabricated prior to final approval shall be at the Contractors' risk. No

changes shall be made on the approved drawings or samples without the written consent of the Architect/Engineer. Each Shop Drawing or Sample shall be properly identified as to MSU project title and number, Contractor, item, etc., with cover sheet, stamp, tag, etc., so as not to be confused with any other. The Contractor shall direct specific attention with written explanation to any deviation from what is specified or shown on the drawing.

D. Shop Drawings

1. The Shop Drawing will be identified by job name, date, Contractor name and name of person reviewing for compliance with Contract Documents. Shop Drawings are drawings, diagrams, schedules and other data specifically prepared by the Contractor to illustrate some portion of the Work for which submittals are required by the Contract Documents. The purpose of their submittal is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.
2. The Contractor shall review for compliance with the Contract Documents, approve and submit to the Owner all Shop Drawings required by the Contract Documents. Submittal shall be with reasonable promptness and in such sequence as to cause no delay in the Work or in activities of the Owner or their separate Contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Owner without action.
3. By approving and submitting Shop Drawings the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.
4. The Owner will review and approve or take other appropriate action on the Shop Drawings submitted by the Contractor only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Review of Shop Drawings is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Owner's review shall not constitute approval of safety precautions or, unless otherwise stated by the Owner, of any construction means, methods, techniques, sequences or procedures. The Owner's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

E. Samples

1. Samples shall be submitted as directed to provide a representative sample. Samples shall be physical examples, from the actual materials, to be used whenever practical. All

packing and transportation charges on samples shall be paid by the Contractor.

2. A Submittal record shall be created in Unifier for each sample, indicating the manufacturer and specifications, and informing the Owner of the status of delivery of the physical sample. The physical sample will be retained by the Owner. The Submittal record will be returned to the Contractor with a review status by the Owner.
3. Approval of Samples shall be generally for quality, color, and finish, and shall not modify the requirements of any of the Contract Documents as to dimensions or design.

1.5 SPECIAL PROCEDURES

A. Constructor Safety Requirements

1. MIOSHA regulations apply to all university projects. Each constructor is responsible for ensuring compliance with “all applicable requirements” that govern their work, including any additional regulations, interpretations, clarifications, and consensus standards incorporated therein by reference.
2. MSU-specific safety requirements are published in the Constructor Safety Requirements Manual. The most current version of this manual is available at <http://www.ehs.msu.edu/contractors>. Constructors will be held to the version of the manual in effect at the time of contract execution.
3. Requirements specific to work at Michigan State University generally fall into one of two categories:
 - a. Administrative Requirements, such as but not limited to communication, planning, documentation, submittals, notifications, reporting, and inspections.
 - b. Safety Requirements unique to work at MSU, such as but not limited to Control of Hazardous Energy/Lock Out Tag Out, Confined Space, Electrical, Excavations, Fall Protection, Hot Work, etc.
4. Constructor shall submit a Site-Specific Safety Plan or work under an existing Area-Specific Safety Plan where allowed, as described in the MSU Contractor Safety Requirements Manual.

B. Hazardous Materials

1. If the Contractor suspects a material, preexisting or newly discovered, within the scope of this project to be a hazardous material such as, asbestos, lead, polychlorinated biphenyl or any other potentially hazardous material, that has not already been identified and/or in the scope of work for the Contractor to abate, notify the Project Representative immediately. Do not impact or disturb the material in question until it has been determined to either be non-hazardous, included in the original scope of work,

or until other arrangements can be made with the project representative and the MSU Department of Environmental Health and Safety (EHS).

2. Due to the age of buildings on the Michigan State University campus, all coated surfaces shall be assumed to contain lead-based paint. This includes but is not limited to any type of paint, primer, coating, lacquer, or varnish on any building component. Proper precautions must be taken to ensure that workers and building occupants are not exposed to airborne lead concentrations at or above the OSHA Action Level (AL) of 30 ug/m³.
3. If work will be conducted on any coated surface at MSU, the contractor must submit to the Department of Environmental Health and Safety (EHS) and Infrastructure Planning and Facilities Project Representative current proof of appropriate detailed written lead work plan in accordance with 29 CFR § 1926.62 (Michigan Part 603). This submittal will include proof of training, written respirator program, and negative exposure assessments from projects with similar conditions at a minimum. Contractors performing work on campus must follow the provisions of the MSU Lead Management Program from EHS.
4. Any work that impacts Lead shall comply with the provisions of the MSU EHS Lead Management Plan.
5. Any work that impacts Asbestos shall comply with the provisions of the MSU EHS Asbestos Management Plan.

1.6 Requests for Information

- A. Requests for Information (RFI's) shall be processed within Unifier, using the RFI business process. Failure to complete the tasks within the Unifier time frames shall not be a basis for a delay claim.

PART 2 – PRODUCTS
Not Used

PART 3 – EXECUTION
Not Used

END OF SECTION

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 REGULATORY REQUIREMENTS

A. Applicable Codes, Standards, and Regulations

1. The following list of codes and regulations, establish the minimum requirements applied to work done at MSU. Where the specifications or plans, exceed the applicable code, the specifications and plans shall be followed.
 - a. NFPA National Fire Codes.
 - b. NFPA National Electrical Code.
 - c. ICC International Building Code.
 - d. ICC International Plumbing Code.
 - e. ICC International Mechanical Code.
 - f. State of Michigan Elevator Safety Act - Act 227, P.A. 1967.
 - g. State of Michigan Boiler Act - Act 290, P.A. 1965.
 - h. State of Michigan Construction Code Act - Act 230, P.A. 1972, as amended.
 - i. State of Michigan Occupational Safety and Health Act - Act 154, P.A. 1974, as amended.
 - j. Americans With Disabilities Act (ADA) Public Law 101-336.
 - k. Regulations of Air Pollution Control Commission State of Michigan, and the Federal Clean Air Act (42 U.S.C. 1857C - 8 © (1)).
 - l. Soil Erosion and Sedimentation Control - Act 451 of 1994, parts 31 and 91, as amended.
 - m. Environmental Impact Statement Executive Order 1974-4.
 - n. State Fire Safety Board's New Rules for Schools, Colleges, and Universities.
 - o. State of Michigan Safe Drinking Water Act, P.A. 339 of 1976, and Federal Water Pollution Control Act (33 U.S.G. 1319 ©).
 - p. State of Michigan Energy Code (Adopting ASHRAE 90 by reference).

1.2 REFERENCES

A. Abbreviations and Symbols

1. AIA - American Institute of Architects
2. ACI - American Concrete Institute
3. AISC - American Institute of Steel Construction
4. ANSI - American National Standards Institute
5. ASTM - American Society for Testing Materials
6. BOCA - Building Officials and Code Administrators
7. LEED - Leadership in Energy and Environmental Design
7. NFPA - National Fire Protection Association
8. OSHA - Occupational Safety and Health Act
9. SMACNA - Sheet Metal and Air Conditioning Contractors National Association

10. MDOT - Michigan Department of Transportation
11. USGBC - U.S. Green Building Council

1.3 QUALITY CONTROL

A. Testing Laboratory Services

1. All work (materials and installation procedure) shall be tested and inspected by an independent testing and inspection agency, approved by the Project Representative to provide the quality control requirements in accordance with these specifications. Results of these tests and inspections when performed in accordance with these specifications will not be disputed by either party. Failure of the Contractor to provide quality control in accordance with this specification may result in the replacement of the work at the Contractor's expense.

B. Contractor's Responsibilities

1. Submit the name of the proposed testing and inspection agency(s) to the Project Representative for review and approval prior to contracting for such services.
2. Employ and pay the cost of independent testing and inspection as required in this specification. Pay applications from the testing/inspection agency shall be reviewed by the Owner before the Contractor's pay request for testing/inspection services is approved.
3. Advise the testing and inspection agency sufficiently in advance of the work to be inspected in the field to allow time to schedule personnel and equipment to perform the required inspections. Failure of the work to be inspected shall be the sole responsibility of the Contractor regardless of the fault of the testing and inspection agency.
4. Furnish certificates to authenticate the type and or quality of products furnished for installation as required in these specifications.
5. Shall notify the Project Representative in a timely manner when and where testing is to take place to provide sufficient time for the Project Representative to be in attendance.

C. Testing & Inspection Agency Responsibilities

1. Perform all testing and inspection of the work in accordance with these specifications.
2. Furnish qualified personnel and sufficient equipment in a timely manner when required by the Contractor and/or Project Representative to perform all testing and inspection in accordance with these specifications.
3. Provide written reports (2 copies) in a timely manner of the work tested and inspected. The reports shall include complete material test results and for in-place material, a sketch showing the exact location where the test was taken on the project site.

4. The inspection and testing agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirements of the Contract Documents, nor to approve or accept any portion of the work.
5. Work will be checked by representatives of the testing agencies as it progresses, but failure to detect any defective work or product will not in any way prevent later rejection when such defect is discovered, nor will it obligate the Owner to final acceptance. When it appears that the work or product furnished is in non-conformance with the Contract Documents, the representative of the testing agency will direct the attention of the Project Representative and Contractor to such non-conformance.

D. Authority of the Project Representative

1. May order additional tests and inspection beyond those required, if in their opinion, the subject work may not meet specification. The costs for these tests and inspections shall be borne by the Contractor.
2. May terminate the testing and inspection agency. The Contractor shall then furnish to the Project Representative the name of an additional agency for approval.
3. May perform quality control tests and inspections.

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1- GENERAL

1.1 TEMPORARY UTILITIES

A. General

1. The Contractor for the general construction work shall be responsible for all items specified in Section 015000. The Contractor shall install and maintain all items until project is finished and shall remove same and restore areas to their original conditions.

B. Temporary Electricity

1. The Contractor may use any permanent electrical outlets in the construction area.
2. Construction lighting shall be turned off during unoccupied periods, with the exception of lighting required for safety reasons such as path of egress.
3. Temporary service for heavy loads, or where no other service is available, will be provided by the general Contractor at the Contractor's expense. Power for temporary service connected to public utility company lines, (before an MSU service meter) will be paid for by the Contractor. Power for temporary service connected to the MSU power system, or after an MSU service meter, will be furnished by the Owner at no charge.
4. The contractor shall install temporary lighting within the construction area consistent with MIOSHA requirements.

C. Temporary Heat

1. All equipment and labor for temporary heat shall be furnished by the Contractor. Use of University utilities for temporary heat will be at the discretion of the Owner. The cost of natural gas or steam for heating new structures or other applications requiring temporary heat will be paid by the Contractor.

D. Temporary Telephone Service

1. If there is no University phone at the immediate work site, the Contractor shall provide a temporary job site telephone and/or provide the Job Superintendent with a phone activated paging device or cell phone.

E. Temporary Water

1. Each Contractor may use water for construction purposes from the nearest University source.

F. Temporary Sanitary Facilities

1. A toilet in the work area may be used by the Contractor's employees.
2. Where there is no toilet in the work area, an approved chemical type portable toilet will be provided by the Contractor.

1.2 VEHICULAR ACCESS AND PARKING

A. Parking Regulations

1. Unless otherwise directed, all non-University personnel working on the Campus of Michigan State University are required to park as Visitors. Between 7:00 a.m. and 6:00 p.m., Monday through Friday, Visitors may park only in metered parking spaces or gate controlled parking lots.
2. Commercial permits are available from the Department of Police and Public Safety (355-8440), which will allow parking in specific areas. The cost of a commercial permit is the responsibility of the Contractor.
3. Permits for one day parking in areas reserved for university employees are available to Contractors or their personnel from the Department of Police and Public Safety at the current rate, with a signed note from the Project Representative.
4. Parking permits are not required for vehicles south of Mount Hope Road.

1.3 TEMPORARY BARRIERS AND ENCLOSURES

A. General

1. The Contractor shall provide, install, and maintain necessary temporary barriers, warning signs, and other safety measures to protect the public, property, and plant growth.
2. The Contractor will be required to work within limitations imposed by the University Police and Public Safety Department with respect to vehicular and pedestrian traffic. When approved by the Owner, if it becomes necessary to occupy a traffic lane for **ANY** length of time, proper directional signs, flashers and barricades shall be provided at the Contractor's expense in accordance with the most recent edition of the Michigan Manual of Uniform Traffic Control Devices. The Contractor will replace if damaged or stolen, all barricades, flares, and night protection at Contractor's expense, all being considered as incidental to the work.

B. Dust Control

1. Temporary Partitions
 - a. The Contractor shall construct necessary temporary partitions to isolate the new

work from the existing building.

- b. Unless noted otherwise, construct partitions of 2" x 4" wood studs, 16" on center and heavy mil, fire retardant plastic sheeting securely attached so as to keep dust, dirt, and debris from spreading beyond the work area.

2. Return Air Openings

- a. The Contractor shall block all return air openings in the work area so that dust will not carry into other areas of the building.

3. Site Dust

- a. The General Contractor shall be responsible for eliminating airborne dust in the work area and staging area by application of appropriate mitigation measures, as approved by the Owner.

C. Security Measures

1. Temporary & Access Keying

- a. The MSU Infrastructure Planning and Facilities Key Shop will furnish construction keys, and furnish and install construction cores for use during construction as deemed necessary by the Project Representative. The Contractor may pick up the construction keys at the Key Shop with the form, "Authorization for Construction Cores and Keys," completed and authorized by the Project Representative.
- b. All construction keys and facility keys issued to a Contractor for a particular project will be returned to the Project Representative before final payment will be processed. If keys are not returned, the Contractor may be held responsible to pay for re-keying any and all affected facilities.

2. Campus Security and Access Control System

- a. When deemed necessary by the Project Representative, temporary security access cards will be issued to the Contractor for building exterior doors, rooms, and/or spaces that are secured by the Campus Security and Access Control System.
- b. On construction projects where the security system is active and armed during construction the Contractor will be assessed a false alarm fee for any unauthorized entry of a secure space and/or setting off an alarm by propping open secured doors/windows, cutting into the security wiring, removing security devices, or any other action causing an alarm.
- c. The false alarm fees shall be as follows:

| | |
|------------------|-----------------|
| First occurrence | No assessed fee |
|------------------|-----------------|

| | |
|----------------------------------|--------------|
| Second occurrence | \$500 |
| Third and subsequent occurrences | \$1,000 each |

- d. The breaches of security and associated fees shall be assessed by project to the Contractor, not by sub-contractor, vendor, supplier, etc.

D. Campus Woody Plant Protection

1. Coordinate all plant protection and site work limits with the Project Representative. **SITE WORK CANNOT COMMENCE WITHOUT A PRE-CONSTRUCTION WALK-THROUGH.**

All Contractor employees engaged on the project site shall attend, or are expected to have attended, the Contractor Woody Plant Protection Seminar, hosted by MSU's Landscape Services (formerly Grounds Maintenance) Division. This seminar will be presented on an annual basis at a minimum. Coordinate with the Project Representative for times and locations of the seminar(s).

2. Work by Owner

- a. Tie-back of existing plantings. Pruning, thinning, and sealing of existing plantings. Root pruning and root protection of exposed roots. Watering of existing trees under stress. Salvaging of existing small trees, shrubs, and other plant growth that the Owner wishes to retain.
- b. Tree protection barricades will be provided by the Owner. Plant damage occurring within installed barricades does not absolve the Contractor from damage assessment.
- c. Work shall be performed by MSU Landscape Services Department unless otherwise arranged, as needed to provide either preventative or remedial care to plants on a construction site. Contractor shall immediately contact the Project Representative should "protected plants" be compromised in violation of agreed upon fencing locations and work limits. Failure to communicate promptly could result in 100% damage assessment of fines.

3. Protection of Plantings

- a. Protect existing trees and other vegetation indicated to remain in place. Prohibited practices include breaking of branches, scraping of bark, or unauthorized cutting; nailing or bolting into trees or plants; use of trees or plants as temporary support (i.e. for cables); unauthorized filling, excavating, trenching or auguring within the root zone; compaction/driving over the root zone; (see definitions below), storage of any materials or vehicles within the root zone; dumping of construction waste or materials (including liquids); unauthorized removal or relocation of woody plants; removal of tree protection barricades or construction fencing prior to completion of project.

- b. Compaction within the root zone is the increasing of the soil density caused by heavy equipment or concentrated foot traffic which significantly alters the soil conditions from that which was present prior to construction.
 - c. The root zone of a tree is one and a half the distance of plant crown drip line outward from the stem, along undisturbed grade. Should placement of concrete be specified or authorized by the Owner within the root zone, a sulfur application will be applied by the Owner. The Contractor shall notify the Owner at least 48 hours prior to pouring concrete. Trees to receive sulfur shall be identified by Owner.
4. Damage
- a. Damage to campus woody plants shall include any of the items indicated in paragraph 2.a above as determined solely by the Owner. The Owner shall evaluate damage and establish proportional fines up to 100% of the value shown below, regardless of the current disposition of the plant.
 - b. 100% Value Schedule for Campus Trees
 - 1" - 3" caliper \$200/inch
 - 3" - 6" DBH \$290/inch
 - 6" - 9" DBH \$380/inch
 - 9" - 12" DBH \$480/inch
 - 12" - 15" DBH \$670/inch
 - 15" DBH or greater \$960/inch
 - c. DBH is the tree trunk diameter at breast height.
 - d. Replacement value for shrubs, vines, and perennials shall be assessed at three times the current market cost of the plant.
 - e. Alternatives to the above protective measures, or any variations, must be approved by the staff Landscape Architect and the Project Representative. (Measures may include: thinning and root pruning, fertilization, aeration, boring & jacking, hand excavation, supervision by campus arborist, seasonal schedule recommendations.) Alternatives would be based on the specific requirements of the plant species in question, as determined by the staff Landscape Architect.

1.2 TEMPORARY CONTROLS

A. Soil Erosion and Sediment Control (SESC)

- 1. The Contractor shall comply with all Contract Documents, approved SESC plans, permit conditions and with Parts 31 and 91 of Public Act 451 of 1994. The Owner shall obtain a Soil Erosion and Sedimentation Control (SESC) permit from the appropriate Municipal (MEA) or County (CEA) Enforcing Agency. Permit Fees and MEA/CEA

routine inspections will be paid for by the Owner.

2. Prior to beginning any earth change, the Contractor shall retain a DEQ Certified Storm Water Operator (CSWO) to provide the required SESC reports (which include the weekly and storm event reports as well as all follow up reports for both violations and storm event corrections) on the standard DEQ form. The Contractor shall provide the reports to the Owner on a weekly basis, and retain those reports for 3 years.
3. Prior to beginning any earth change, and during the life of the contract, the Contractor shall install and maintain all temporary SESC measures as shown on the Contract Documents, SESC plans, and as directed by the Owner, CSWO, DEQ, or MEA/CEA, until MSU officially takes over responsibility for the site.
4. Immediately prior to MSU taking responsibility for the site, the Contractor:
 - a. Will be required to clean all catch basins affected by the construction, both within the Contract Limits and all surrounding roads and lawn areas when soil may have spread as the result of construction activities.
 - b. Shall put all temporary SESC measures in satisfactory condition as determined by the CSWO.
5. All temporary SESC measures will remain in place and will become the property of the Owner when responsibility for maintaining the SESC measures becomes the Owner's responsibility.
6. The Contractor shall conduct all excavation, filling, grading and clean-up operations in a manner such that sediment generated by wind or water is not discharged off site or into any storm sewer, drainage ditch, river, lake, air or underground utility system. Stage the work per plan to minimize the area of exposed soil, thereby reducing the opportunity for soil erosion.
7. If sediment extends beyond the project limits, the Contractor shall be responsible for cleanup and restoration of all surfaces and utility systems to the condition that existed prior to the Contract award.
8. All SESC measures shall be maintained daily.
9. Should violations (irrespective of a fine being assessed) be identified by the Owner, CSWO, MEA/CEA or DEQ, they shall be corrected within 24 hours of notification. The correction(s) shall be approved by the Owner, CSWO, MEA/CEA or DEQ. All subsequent inspections performed by the Owner, CSWO, MEA/CEA or DEQ as a result of the violation (and any other associated costs) will be paid by the Contractor. If identified violations are not corrected within 24 hours of written notice, the Owner shall have the right to make necessary repairs at the Contractor's expense, without being required to provide further notice to Contractor.
10. Fines assessed as a result of the violation for non-compliance of the SESC provisions, will be paid by the Contractor. If a "Stop Work" order for non-compliance is issued, a

time extension request for that time period will **not** be granted. (Fines could be assessed up to and including \$25,000/DAY for each violation.)

11. Only one Seven Day Notice will be issued for violations of the SESC provisions. Should subsequent violations be identified, the contractor will be expected to make the satisfactory correction within 24 hours of notification. Should the corrections not be made, the Owner, without further notice to the Contractor, will correct the violation. The cost of the corrective action will be charged to the Contractor.

1.5 CONSTRUCTION DEBRIS CONTROL

- A. The Contractor shall provide and administer a system for disposal of construction debris, and shall be responsible for seeing that the site and the new building are at all times free of accumulated debris caused by the construction. For purposes of this paragraph, debris shall include ALL materials used in construction including construction roads and pads. Special attention should be given to materials that could leach into the ground, including but not limited to lime based materials, all chemicals, and any liquids except clean water.
- B. This shall include, but not be limited to, rubbish containers conveniently located throughout the site for the daily disposal of debris directly into them from each work location. Debris shall not be allowed to accumulate on the ground through-out the site overnight.
- C. All combustible debris shall be removed to a solid waste disposal site properly licensed under Act 87 of the Public Acts of 1965 of the State of Michigan.
- D. No burning of debris will be permitted on the Project site or elsewhere on the Owner's property.
- E. Should the Contractor not execute the work required in this section, the Owner reserves the right to perform the work by other forces and deduct the cost from the contract price.

1.6 CONFINED SPACES

- A. The workplace may contain permit confined spaces and entry is allowed only through compliance with a confined space program as defined by 29 CFR 1910.146. The contractor is responsible for assessing real or potential atmospheric hazards and other serious safety and health hazards in the confined space. MSU will make available records of known confined space hazards. The contractor shall provide all necessary equipment for confined space entry. If MSU personnel will be working in or near confined spaces occupied by the contractor, the contractor is required to coordinate activities with the Project Representative. The contractor will inform the Project Representative of procedures followed and hazards confronted or created during entry operations.

1.7 LOCK-OUT/TAG-OUT PROCEDURE

- A. The Contractor shall conform to Michigan State University Infrastructure Planning and Facilities lock-out/tag-out procedure. Copies are available from Planning, Design and

Construction, Infrastructure Planning and Facilities Building, Michigan State University.

1.8 FM RED TAG PERMIT MONITORING SYSTEM

- A. When working on fire protection sprinkler systems the Contractor shall conform to the Factory Mutual Red Tag Permit Monitoring System modified by notifying the Project Representative in lieu of the Emergency Organization, Public Fire Department, and Factory Mutual. Documentation is available from Factory Mutual, (781) 255-4359.

1.9 FM HOT WORK PERMIT SYSTEM

- A. For all hot work operations, the Contractor shall conform to the Factory Mutual Hot Work Permit System modified by notifying the Project Representative in lieu of the Fire Safety Supervisor and Factory Mutual. Documentation is available from Factory Mutual, (781) 255-4359.

1.10 HAZARDOUS SUBSTANCE SPILLS

- A. Releases of hazardous substances that pose a significant threat to health and safety, or that, by their very nature, require more than a routine response, are emergency situations. If a release of an emergency nature occurs, call 911 immediately. Provide all applicable information and stay on the phone until told to hang up. If a non-emergency release of a hazardous substance occurs, contact the MSU Infrastructure Planning and Facilities Project Representative immediately.

1.11 ROOF PROTECTION

- A. In the event a roof has to be used as a storage, work and/or walkway area, the following protective measures shall be employed.
 1. The size and location of the storage, work or walkway areas shall be approved by the MSU Infrastructure Planning and Facilities Project Representative.
 2. The storage, work or walkway area protection shall consist of a 1-inch layer of water resistant insulation such as EPS, and a layer of ½ inch plywood. Stagger the seams of the insulation and plywood; use plywood clips to prevent cupping.
 3. The perimeter of the area shall be lined with barricades and warning tape to ensure that all traffic will stay on the protected areas.

1.12 CRANE HOISTING

- A. Crane hoisting of equipment or materials over occupied spaces shall be performed at the convenience of the Owner, with arrangements made by the Project Representative.

PART 2 – PRODUCTS (Not Used)

Owen Graduate Hall - West
Convert Office Space to Student Rooms
MSU Project #CP22127

GENERAL REQUIREMENTS
TEMPORARY FACILITIES AND CONTROLS
PAGE 015000-9

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Storage and Protection

1. The Contractor shall be responsible for work, material, and equipment until finally inspected, tested, and accepted. The project shall be protected against theft, injury, and damage. Material and equipment received on the site shall be carefully stored until installation.

B. Staging Area

1. Should the Contractor require exterior staging or on-site storage of materials - the location of this area must be agreed upon prior to actual use of the space by the Project Representative and the Contractor. The area will not be within the drip-line of any tree or in plant beds, as per Section 015000.1.3.D.3.
2. If this exterior area is outside the fenced project site, the area shall be enclosed with a minimum 4' high welded wire fence, with metal fence T-posts not exceeding 8' on center. Fence fabric shall be supported by either a top bar or a tension cable.
3. The Contractor shall be responsible for the cost of placing and removing the fence.
4. Each designated area shall have only one access route from the road or drive.
5. The area is not to be used for employee parking, but may be utilized by the Contractors' vehicles and equipment necessary to service the project.
6. Any areas damaged as a result of the staging operation shall be repaired by the Contractor, at no additional cost to the Owner.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 017000 - EXECUTION REQUIREMENTS

PART 1- GENERAL

1.1 EXAMINATION

A. Pre-Bid Site Inspection

1. Each Bidder shall be held to have visited the site of the proposed work before submitting their proposal and to have familiarized themselves with all existing conditions affecting the execution of the work in this project. No allowance or extra consideration on behalf of the Contractor or Subcontractor will subsequently be made by reason of failure to observe the site conditions.

1.2 PREPARATION

A. Protection of Work and Property

1. Contractor shall protect existing and new work as required by this construction or as requested by the Project Representative.
2. Interior Protection
 - a. This will include, but not be limited to the wall, floor, and ceiling finishes to remain at the construction site, along the access route to the site, existing elevators, and other areas such as roofs and mechanical rooms where related work is specified or required.
3. Exterior Protection
 - a. The Contractor shall be responsible for any damage to existing facilities, including but not limited to the following: buildings, trees and shrubs, walks, roads, utility systems, terraces and steps, lights, and unreasonable turf damage as determined by the Project Representative. Damage shall be repaired by the Contractor in accordance with MSU's Construction Standards at no cost to the Owner.
 - b. No crawler cranes, bulldozers, or other equipment, fitted and running on steel treads, shall be permitted to traverse any walk, road, street, or other thoroughfare on the Campus of Michigan State University. Where it is necessary to unload such equipment on these thoroughfares, and when approved by the Project Representative, planking shall be provided to protect same. If this is not done, and damage is observed, the cost of replacing shall be the burden of the Contractor causing such damage.

1.3 EXECUTION

A. Cutting and Patching – Concrete and Masonry

1. The Contractor shall be responsible for any cutting, fitting, and patching that may be required to complete this project, except for core drilling required for mechanical and electrical installations, which shall be the responsibility of the Mechanical or Electrical Contractor.
2. The Contractor shall not endanger any work of any other Contractors by cutting, excavating, or otherwise altering any other work and shall not cut or alter the work of any other Contractor except with the written consent of the Architect/Engineer.
3. No cutting of structural members of the building, likely to impair its strength, shall be done without written approval from the Architect/Engineer.
4. To avoid damage to hidden utilities and structural re-enforcement any cutting or core drilling over one inch in diameter, through concrete floors and slabs will be x-rayed/scanned by the contractor prior to cutting.
 - a. A qualified engineer will conduct an on-site assessment before any cutting or drilling of a pre-tensioned or post-tensioned component or other structural component of a building or structure commences. The assessment will be documented and provided to the person contracted to carry out the work.
 - b. If any load bearing member is cut, cored or removed all the requirements of 29 CFR 1926 Subpart T (LARA Part 20) shall apply. This will require notifications to the DEQ 10 working days before cutting begins. Emergency notifications are possible under specific conditions.
 - c. The responsible person for the project shall ensure substantial compliance with the requirements for exposure to Silica Dust. Substantial compliance will also be required for all other construction safety standards and published by the State of Michigan or Federal OSHA.
 - d. Work shall be conducted outside of the regular hours to avoid disturbing the building occupants. An exception to this rule will be granted only by the project manager and shall be in writing.
 - e. The MSU project representative or employee shall be responsible for locating all utilities in the area to be cut. This part of the job is mandatory and shall be given appropriate attention. Minimally the responsible person shall review all available prints and consider structural scanning. The MSU representative or employee shall take necessary steps to isolate and lock out any energy sources that may be jeopardized by the cut to protect worker safety and avoid equipment damage. In some cases, utilities will need to be cut and relocated to conduct the work. The responsible person shall take steps to notify repair persons in advance of the anticipated timing and scope of the repair project or the need for temporary services.
 - f. Responsible person shall inspect the area to ensure that no damage has occurred and that the area is cleaned to an acceptable level.

5. Cutting and Patching for Mechanical Work

- a. The Mechanical Contractor shall be responsible for any core drilling required to complete their work.
- b. The Mechanical Contractor shall be responsible for the accurate location of all openings necessary for the installation of the mechanical work. Any additional openings required to move their work due to an error in the initial layout and the repair of inaccurate openings, shall be made at the expense of the Mechanical Contractor.

6. Cutting and Patching for Electrical Work

- a. The Electrical Contractor shall be responsible for any core drilling required to complete their work.
- b. The Electrical Contractor shall be responsible for the accurate location of all openings necessary for the installation of the electrical work. Any additional openings required to move their work due to an error in the initial layout and the repair of inaccurate openings, shall be done at the expense of the Electrical Contractor.

B. Salvaging of Materials

1. Materials or equipment shown on drawing or specified herein to be removed, which are not to be reused or salvaged, shall become the property of the Contractor and will be removed from University property and disposed of legally.
2. Deliver all fire alarm equipment removed from the job to the IPF Storage Building 210, 1457 Recycling Drive, East Lansing, MI.
3. Deliver all Best key cylinders to be removed from the job to the Key Shop in the Infrastructure Planning and Facilities Building, 1147 Chestnut Road, East Lansing, MI.

1.4 CLEANING UP

- A. Cleaning up shall be in accordance with the General Conditions of the Contract.
- B. No rubble, dust, or debris shall be allowed to accumulate or be transported throughout the building.
- C. A thorough final cleaning of all of the adjacent streets, as specified by the Project Representative, will be required before final payment is made.
- D. If the Contractor fails to clean up, the Owner may do so and the cost thereof shall be charged to the Contractor.

1.5 STARTING AND ADJUSTING

- A. Refer to each Division for requirements.

1.6 CLOSEOUT PROCEDURES

- A. In general, one or more walk-throughs will be performed with the Contractor and punch lists developed of items to be completed before the project can be closed out.

1.7 CLOSEOUT SUBMITTALS AND PROJECT DELIVERABLES

A. Operation and Maintenance Data

1. The Contractor shall provide operation and maintenance data as required in this specification, and submit the required information through use of the Unifier system.
2. Submittals for equipment and systems shall contain the manufacturer's information on installation, balancing, operating, maintenance, lubrication, and repair instructions and parts list for each component.
3. Please refer to MSU Document Submittal Standards at:
<http://ipf.msu.edu/construction/business-partners/standards-for-construction/index.html>

B. As-Built Drawings

1. Submission of all As-built Drawings called for in this specification shall precede request for final payment.
2. The Contractor shall submit As-built Drawings in electronic (.pdf) format, that is not password protected, indicating any deviations from the Contract Drawings, including contract Change Orders. Upon request of the Owner, printed copies of the As-Built drawings shall be provided as well.
3. Provide any Building Information Model (BIM) data developed for this Project to the Project Representative.

C. Facility Asset Data Exchange (FADE) Log

1. The Constructor shall furnish all information as indicated on the FADE log spreadsheet. The University's FADE procedure and requirements for asset tracking and populating the log can be found at the following web addresses:

FADE process during design phase:

<https://us.promapp.com/ipfmsu/Process/Minimode/Permalink/GkN4dmXiYTf9MzXAPt5ydu>

FADE process during construction:

<https://us.promapp.com/ipfmsu/Process/Minimode/Permalink/C3uQcSUvsfB7pLuXYgcL3P#>

Should the Owner change the FADE process change in form or content, the Constructor is not relieved of fully executing the work required to compile the information and complete the Log.

E. Certificates of Inspection

1. The Contractor shall provide a copy of all Certificates of Inspection called for in this specification. Refer to Section 013000 Part 1.4.B.

F. Warranty

1. The Contractor shall provide a written guarantee stating that all work performed and material furnished is free from all defects in workmanship, and material for a period of one year, unless noted otherwise, after the equipment has been accepted by the Owner. Final payment or Certificate of Substantial Completion, whichever is issued first, shall constitute Owner acceptance.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 019999 - AVAILABILITY OF ELECTRONIC FILES

PART 1 - GENERAL

1.1 POLICY

- A. As a service to bidders, contractors, subcontractors, vendors, material suppliers and others needing electronic copies of drawing files, the Architect will provide electronic files via file transfer through the Project Website in accordance with the following policy.
1. In accepting and utilizing any drawings or data generated and furnished by WTA Architects, the Receiver agrees that all such electronic files are instruments of service of WTA Architects and its consultants, who shall be deemed the author, and shall retain all common law, statutory law and other rights, without limitation, including copyrights.
 2. The Receiver agrees not to reuse these electronic files, in whole or in part, for any purpose other than for the Project. The Receiver agrees not to transfer these electronic files to others without the prior written consent of WTA Architects or its consultants. The Receiver further agrees that WTA Architects and its consultants shall have no responsibility or liability to Receiver or others for any changes made it shall be the Receiver's responsibility to be aware of changes made by WTA Architects, its consultants or the Owner.
 3. It is further understood and agreed that the undersigned Receiver will hold WTA Architects and its consultants harmless, indemnify and defend WTA Architects and its consultants from all claims, liabilities, losses, etc., including attorney's fees arising out of the use or misuse of the transferred items.
 4. It is understood and agreed that the items transmitted are prepared from electronic files current at the time of preparation. **All files are AutoCAD 2018.** The Receiver will specify on request form if an older version is required.
 5. This information does not waive the need to verify and review current field conditions and the status of Addenda and/or Bulletin documentation.
 6. As a record of information to be transmitted, WTA Architects will prepare a duplicate back-up for its files, which may be electronic or hard-copy.
 7. Compensation for providing this material will be as follows:
 - a. Base Fee of \$250 for 1 to 3 drawings.
 - b. Base Fee of \$500 for 4 to 10 drawings.
 - c. For each additional drawing after 10 the fee is \$40.00 per drawing (i.e. 11 drawings = \$540)
 8. Payment must be provided along with a signed copy of the Release Letter before files will be released.

1.2 REQUEST PROCEDURE

- B. To receive files the attached Release Letter must be completed in full and submitted to the Project Manager at WTA Architects.
1. A signed copy of the Release Letter must be submitted; faxed or emailed copies will be accepted. However, files will not be exchanged until payment has been received.
 2. Upon remittance of the signed Release Letter and Fee, allow five working days for processing.

Firm Requesting Files:

Date: _____

Name: _____
Company: _____
Address: _____
City, State, Zip: _____

Phone: _____

Re: Letter of Authorization for Electronic File Transfers

Project Name: Owen Graduate Hall – West: Convert Office Space to Student Rooms

WTA Project No.: _____

Dear Sir:

Per your request, WTA Architects will transmit the requested electronic files via file transfer through the project website upon receipt of this letter with conditions of agreement as stated.

1. In accepting and utilizing any drawings or data generated and furnished by WTA Architects, the Receiver agrees that all such electronic files are instruments of service of WTA Architects and its consultants, who shall be deemed the author, and shall retain all common law, statutory law and other rights, without limitation, including copyrights.
2. The Receiver agrees not to reuse these electronic files, in whole or in part, for any purpose other than for the Project. The Receiver agrees not to transfer these electronic files to others without the prior written consent of WTA Architects or its consultants. The Receiver further agrees that WTA Architects and its consultants shall have no responsibility or liability to the Receiver or others for any changes made it shall be the Contractors responsibility to be aware of changes made by WTA Architects, its consultants or the Owner.
3. It is further understood and agreed that the undersigned will hold WTA Architects and its consultants harmless, indemnify and defend WTA Architects and its consultants from all claims, liabilities, losses, etc., including attorney's fees arising out of the use or misuse of the transferred items.
4. It is understood and agreed that the items transmitted are prepared from electronic files current at the time of preparation. **All files are AutoCAD 2018**, unless requested otherwise.
5. This information does not waive the need to verify and review current field conditions and the status of Addenda and/or Bulletin documentation.
6. As a record of information to be transmitted, we will prepare a duplicate back-up for our files, which may be electronic or hard-copy.
7. Compensation for providing this material will be as follows: Base Fee of \$250 for 1 to 3 drawings and a Base Fee of \$500 for 4 to 10 drawings; for each additional drawing after 10 the fee is \$40.00 per drawing (i.e. 11 drawings = \$540). Payment must be provided along with a signed copy of this form before files will be released. Please remit to WTA Architects and allow five working days for processing.

Fee: \$ _____ Drawings: _____

Signed: _____ Printed Name/Title: _____

To be Completed by WTA Architects, Inc.

| | |
|-----------------------------|----------------------|
| Released (Signed By): _____ | WTA Architects, Inc. |
| Printed Name/Title: _____ | Date: _____ |

END OF SECTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Salvage of existing items to be reused or recycled.

1.2 MATERIALS OWNERSHIP

- A.** Unless otherwise indicated, demolition waste becomes property of Contractor.
- B.** Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 PREINSTALLATION MEETINGS

- A.** Predemolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

- A.** Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property for dust control and for noise control. Indicate proposed locations and construction of barriers.
- B.** Schedule of selective demolition activities with starting and ending dates for each activity.
- C.** Predemolition photographs or video.

1.5 CLOSEOUT SUBMITTALS

- A.** Inventory of items that have been removed and salvaged.

1.6 FIELD CONDITIONS

- A.** Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B.** Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
1. Before selective demolition, Owner will remove the following items:
 - a. All loose furnishings.

- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.
- G. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.7 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
- C. Inventory and record the condition of items to be removed and salvaged.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 3. Do not use cutting torches until work area is cleared of flammable materials. 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.
 4. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
 5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 6. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area designated by Owner.
 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.

4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.5 CLEANING

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 024200– CONSTRUCTION WASTE MANAGEMENT

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 administrative and procedural requirements for the following:

- 1. Salvaging nonhazardous demolition and construction waste.
- 2. Recycling nonhazardous demolition and construction waste.
- 3. Disposing of nonhazardous demolition and construction waste.

- B. Related sections include the following:

- 1. Division 01 Section “General Requirements – Temporary Facilities and Controls.”

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations and clearing debris including soil, vegetation, and rocks are not to be included.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Collect, reprocess and reuse of materials diverted or recovered from solid waste stream.
- E. Salvage: Recovery of demolition or construction materials from existing buildings or construction sites and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction materials from existing buildings or construction sites and subsequent incorporation into the Work.

1.4 PERFORMANCE GOALS

- A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 50 (75) percent by weight of total waste generated by the Work.

1.5 SUBMITTALS

- A. Waste Management Plan: Submit 3 copies of plan within 14 days of date established for commencement of the Work
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit 2 copies of report. Include separate reports for demolition and construction waste. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons.
 - 4. Quantity of waste salvaged, both estimated and actual in tons or cubic yards.
 - 5. Quantity of waste recycled, both estimated and actual in tons or cubic yards.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons or cubic yards.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- C. Waste Reduction Calculations: Before request for Substantial Completion, submit 2 copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licenses to accept them. Include manifests, weight tickets, receipts, and invoices.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section. Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.

2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste reduction plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses and telephone numbers.
 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses and telephone numbers.
 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 5. Disposed materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number for each landfill and incinerator facility.
 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Plan for and describe the means for securing waste containers from unauthorized users.
- E. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
 1. Total quantity of waste.

2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in hauling and tipping fees by donating materials.
7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project. The Construction Superintendent may perform the role of the Waste Management Coordinator.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at the Project site.
 - a. Distribute waste management plan to everyone concerned within three days of submittal return.
 - b. Distribute waste management plan to entities upon execution of their contracts. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - a. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.

- b. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use:

- a. Clean salvaged items.
- b. Pack or crate items after cleaning. Identify contents of containers.
- c. Store items in a secure area until delivery to Owner.
- d. Transport items to Owner's storage area off-site designated by Owner.
- e. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closes, leave door hardware attached to doors.

3.3 RECYCLING DEMOLITION AND CONTRUCTION WASTE, GENERAL

A. General:

- a. Recycle paper and beverage containers used by on-site workers.
- b. Concrete, masonry, or asphalt crushed and reused are to be identified and include in calculations.
- c. Exclude hazardous waste from calculations.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
- a. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - i. Inspect containers and bins for contamination and remove contaminated materials if found.
 - b. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - c. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - d. Store components off the ground and protect from the weather.
 - e. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING CONSTRUCTION WASTE

A. Packaging:

- a. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
- b. Polystyrene Packaging: Separate and bag materials.
- c. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
- d. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Metals: Separate metal by type or to meet requirements of recycling receiver or processor.

3.5 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
- a. Except as otherwise specified, do not allow excessive on-site accumulation of waste materials.
 - b. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

- c. Coordinate with each product manufacturer for take-back programs. Set aside scrap to be returned to manufacturer for recycling into new product.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 035300 - CONCRETE PATCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. The work includes furnishing labor, materials, equipment and incidentals required to repair existing cast-in-place concrete. The area of work and locations will be identified by the Engineer. These locations include horizontal surfaces.

1.2 QUALITY ASSURANCE

- A. Contractor shall demonstrate a minimum of 10 years of experience in concrete restoration and 5 years of experience for the craftsmen performing the work. Materials shall be as specified herein unless otherwise approved in writing prior to bidding. Furnish materials in original sealed containers showing manufacturer's name and labeled to identify the type of product.

1.3 SUBMITTALS

- A. Provide manufacturer's cut sheets for all materials.
- B. Material samples for testing purposes shall be furnished, if requested by the Engineer at no additional cost to the Owner.

1.4 TESTING

- A. Testing, if performed, will be done at the request and with the approval of the Engineer and paid for by the Owner. Should work be found defective as a result of testing, the Contractor will be required to completely rework the portion of the work found defective and pay for any further testing.
- B. Coring or other testing done by the Owner requiring patching shall be patched by the Contractor at no extra cost whether or not the work is found defective.
- C. Defective work will be identified by cracks at perimeter of patch, hollow sounding, inadequate bonding, appearance, etc.

1.5 MATERIALS

- A. Horizontal Repair Mortar: BASF MasterEmaco T1060 Repair Mortar with traffic finish.
- B. Aggregate: Clean, inert material, free of chemicals, coatings or other materials confirming to ASTM C-33. Aggregate used only as recommended by patching material manufacturer.
- C. Reinforcing: ASTM A-615, Grade 60

1.6 EXECUTION

A. Patching.

1. Completely remove loose concrete or aggregate to sound concrete.
2. Sawcut edges of patch area, 3/8" deep. Do not damage existing reinforcing; repair any bars damaged during the work with supplemental reinforcing at no additional cost.
3. Exposed reinforcing bars shall be completely exposed by removing all concrete around bar providing a minimum of one-half inch clearance, all sides. Bar shall be sand blasted clean of all rust, corrosion, and other surface contaminants, near white, ICRI Technical Guideline No. 310.1R.
4. Replace reinforcing with a loss of section exceeding 25% as directed by the Engineer.
5. Apply reinforcing coating to total surface of exposed portion of reinforcing steel per manufacturer's recommendations.
6. Concrete surface must be clean, free of paint, laitance and saturated surface dry per ICRI Guideline No. 310.2 to achieve proper bond.
7. Install patching material per manufacturer's recommendations and ACI 506R, building up patch as required to provide minimum 3/4" cover on reinforcing, scratch coat between lifts.
8. Cure per patch material manufacturer's recommendations.

END OF SECTION

SECTION 061053 – MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Framing with dimension lumber.
 2. Wood blocking and nailers.
 3. Plywood backing panels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements

1.3 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preservative-treated wood.
 2. Power-driven fasteners.
 3. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less.

2.2 WOOD-PRESERVATIVE-TREATED MATERIAL

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction and Category UC3b for exterior construction.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood, nailers, blocking, stripping, and similar members in connection with flashing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:

1. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

- A. Framing: No. 2 grade of any of the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.
4. Hem-fir; WCLIB or WWPA.

2.5 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.

- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

- C. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Eastern softwoods; No. 2 Common grade; NeLMA.
3. Northern species; No. 2 Common grade; NLGA.
4. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

2.6 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.7 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.8 METAL FRAMING ANCHORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Cleveland Steel Specialty Co.
 2. KC Metals Products, Inc.
 3. Phoenix Metal Products, Inc.
 4. Simpson Strong-Tie Co., Inc.
 5. USP Structural Connectors.
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
1. Use for wood-preserved-treated lumber and where indicated.

2.9 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).
- B. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Do not splice structural members between supports unless otherwise indicated.
- D. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.

END OF SECTION

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Shelving and clothes rods.
 - 2. Wood closet paneling.
 - 3. Closet wood trim.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
- B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
- B. Softwood Plywood: DOC PS 1.

2.2 INTERIOR TRIM

- A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):
 - 1. Species and Grade: Red oak; NHLA Clear.
 - 2. Maximum Moisture Content: 10 percent.
 - 3. Finger Jointing: Not allowed.
 - 4. Gluing for Width: Not allowed.
 - 5. Veneered Material: Not allowed.
 - 6. Face Surface: Surfaced (smooth).

7. Matching: Selected for compatible grain and color.

2.3 SHELVING AND CLOTHES RODS

- A. Exposed Closet Shelving: Made from the following material, 3/4 inch (19 mm) thick:
 1. Wood boards as specified above for hardwood lumber trim for transparent finish.
- B. Shelf Cleats: 3/4-by-2-1/2-inch (19-by-64-mm) boards and 3/4-by-5-1/2-inch (19-by-140-mm) boards with hole and notch to receive clothes rods, as specified above for shelving and hardwood lumber trim for transparent finish.
- C. Metal Clothes Rods: 1-5/16-inch- (33-mm-) diameter, stainless steel tubes.
- D. Metal Rod Flanges: Stainless steel.

2.4 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
- C. Multipurpose Construction Adhesive: Formulation, complying with ASTM D3498, that is recommended for indicated use by adhesive manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.2 INSTALLATION, GENERAL

- A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.
 1. Use concealed shims where necessary for alignment.
 2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

4. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.3 INSTALLATION OF STANDING AND RUNNING TRIM

- A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.
 1. Do not use pieces less than 24 inches (610 mm) long, except where necessary.
 2. Stagger joints in adjacent and related standing and running trim.
 3. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
 4. Use scarf joints for end-to-end joints.
 5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 6. Install trim after gypsum-board joint finishing operations are completed.
 7. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
 8. Fasten to prevent movement or warping.
 9. Countersink fastener heads on exposed carpentry work and fill holes.

3.4 INSTALLATION OF PANELING

- A. Board Paneling: Install according to manufacturer's written instructions.
 1. Arrange in random-width pattern suggested by manufacturer unless boards or planks are of uniform width.
 2. Install in full lengths without end joints.
 3. Stagger end joints in random pattern to uniformly distribute joints on each wall.
 4. Select and arrange boards on each wall to minimize noticeable variations in grain character and color between adjacent boards.
 5. Install with uniform tight joints between boards.
 6. Fasten paneling to gypsum wallboard with panel adhesive.

3.5 INSTALLATION OF SHELVING AND CLOTHES RODS

- A. Cut shelf cleats at ends of shelves about 1/2 inch (13 mm) less than width of shelves and sand exposed ends smooth.
 - 1. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled.
 - 2. Space fasteners not more than 16 inches (400 mm) o.c. Use two fasteners at each framing member or fastener location for cleats 4 inches nominal (89 mm actual) in width and wider.
 - 3. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing.
 - 4. Remove adhesive that is squeezed out after fastening shelf cleats in place.

- B. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled.
 - 1. Install shelves, fully seated on cleats.
 - 2. Fasten shelves to cleats with finish nails or trim screws, set flush.

- C. Install rod flanges for rods as indicated.
 - 1. Fasten to shelf cleats, framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
 - 2. Install rods in rod flanges.

END OF SECTION

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes fire-stopping for the following:
 - 1. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- D. Product test reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems bearing marking of qualified testing and inspection agency.
- C. Provide fire-stopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."
- D. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-stopping products to Project sit in original, unopened containers or packages with intact and legible manufacturer's labels identifying product and manufacturer, date of manufacturer; lot number, shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multi-component materials.

- B. Store and handle fire-stopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Do not install fire-stopping when ambient or substrate temperatures are outside limits permitted by fire-stopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilation: Ventilate fire-stopping per fire-stopping, manufacturers' instructions by natural means or, where there is inadequate, forced air circulation.

1.7 SEQUENCING AND SCHEDULING

- A. Do not cover up those fire-stopping installations that will become concealed behind other construction until inspection agency and authorities having jurisdiction, if required, have examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. A/D Fire Protection Systems Inc.
 2. Grace Construction Products.
 3. Hilti, Inc.
 4. Johns Manville.
 5. Nelson Firestop Products.
 6. NUCO Inc.
 7. Passive Fire Protection Partners.
 8. RectorSeal Corporation.
 9. Specified Technologies Inc.
 10. 3M Fire Protection Products.
 11. Tremco, Inc.; Tremco Fire Protection Systems Group.
 12. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

- F. VOC Content: Provide penetration firestopping that complies with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- G. Low-Emitting Materials: Penetration firestopping sealants and sealant primers 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."
- H. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- D. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.3 FIELD QUALITY CONTROL

- A. Construction Manager will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.4 PENETRATION FIRESTOP SYSTEM SCHEDULE

- A. Firestop Systems with No Penetrating Items:
 - 1. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Mortar.
- B. Firestop Systems for Metallic Pipes, Conduit, or Tubing:
 - 1. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Mortar.
- C. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing:
 - 1. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Intumescent wrap strips.
 - e. Firestop device.
- D. Firestop Systems for Electrical Cables:
 - 1. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Silicone foam.
 - e. Pillows/bags.
- E. Firestop Systems for Cable Trays:
 - 1. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Intumescent putty.
 - c. Silicone foam.
 - d. Pillows/bags.
 - e. Mortar.
- F. Firestop Systems for Insulated Pipes:
 - 1. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Intumescent putty.
 - c. Silicone foam.
 - d. Intumescent wrap strips.
- G. Firestop Systems for Miscellaneous Electrical Penetrants:
 - 1. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Intumescent putty.
 - c. Mortar.
- H. Firestop Systems for Miscellaneous Mechanical Penetrants:
 - 1. Type of Fill Materials: One or both of the following:

- a. Latex sealant.
- b. Mortar.
- I. Firestop Systems for Groupings of Penetrants:
 - 1. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Mortar.
 - c. Intumescent wrap strips.
 - d. Firestop device.
 - e. Intumescent composite sheet.

3.5 FIELD QUALITY CONTROL

- A. Inspecting agency will report observations promptly and in writing to Engineer/Architect.
- B. Do not proceed to enclose fire-stopping with other construction until reports of examinations are issued.
- C. Where deficiencies are found, repair or replace fire-stopping so that it complies with requirements.

3.6 CLEANING

- A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of fire-stopping products and of products in which opening and joints occur.
- B. Protect fire-stopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated fire-stopping immediately and install new materials to produce fire-stopping complying with specified requirements.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 MSU ISSUES

1. It the intent of MSU that all joint sealants used on its projects will comply with LEED™ NC 3 Credit Requirements EQ Credit 4.1: Low-Emitting Materials: Adhesives and Sealants.

SUMMARY

- B. This Section includes joint sealants for the applications listed in 3.6 JOINT SEALANT SCHEDULE below, and including those specified by reference to this Section:
- C. Related Sections include the following:
 1. Division 09 Section CERAMIC TILING for sealing tile joints.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

- A. VOC Statement and Product Data: For each joint-sealant product indicated.
- B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- D. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
- E. Qualification Data: For Installer and testing agency.
- F. Preconstruction Field Test Reports: When requested by owner, indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.
- G. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

H. Field Test Report Log: For each elastomeric sealant application.

I. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

J. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 or manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than six pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of nonelastomeric sealant and joint substrate indicated.
 3. Notify M.S.U. Project Manager seven days in advance of dates and times when test joints will be erected.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 4. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.5 PROJECT 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 than those allowed by joint-sealant manufacturer for applications indicated.

4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

A. Special Warranty

1. Provide installation warranty for a period of 5 years against defective materials and workmanship.
2. During the warranty period restore defective work to the standard of the contract documents without additional compensation, including all materials, labor, refinishing and other costs incidental to the work. Within 24 hours after receipt of notice from the owner, inspect the work and immediately repair leaks. Restore work found to be defective as defined in the contract documents, within 10 days after receipt of notice from the owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 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.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Single-Component Neutral-Curing Silicone Sealant; **SEALANT A**

1. Available Products:

- a. Dow; DOWSIL 790 Silicone Building Sealant.

- b. GE Silicones; SilPruf SCS2000.
 - c. Dow; DOWSIL 791 Silicone Weatherproofing Sealant.
 - d. Dow; DOWSIL 795 Silicone Building Sealant.
 - e. Pecora Corporation; 895.
 - f. Dow; DOWSIL 756 SMS Building Sealant.
 - g. Or as approved
2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 50.
 4. Use Related to Exposure: NT (nontraffic).
 5. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.
- E. Multicomponent Immersible Urethane Sealant **SEALANT B**
1. Available Products:
 - a. LymTal International, Inc., Iso-Flex 881 (NS – nonsag)
 - b. LymTal International, Inc., Iso-Flex 880 (P – pourable).
 - c. Or as approved
 2. Type and Grade: M (multicomponent) and NS (nonsag) or P (pourable).
 3. Class: 25.
 4. Uses Related to Exposure: T (traffic), NT (nontraffic) and I (immersible).
- F. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant **SEALANT C.**:
1. Available Products:
 - a. Dow; DOWSIL 786 Silicone Sealant - M
 - b. GE Silicones; Sanitary SCS1700.
 - c. Tremco; Tremsil 200.
 - d. Or as approved
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25.

4. Use Related to Exposure: NT (nontraffic).

2.4 LATEX JOINT SEALANTS

- A. Latex Sealant: Comply with ASTM C 834. **SEALANT D.**
- B. Available Products:
 1. DAP DYNAFLEX 230.
 2. Pecora Corporation; AC-20+Silicone.
 3. Or as approved.

2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) O (open-cell material) or B (bicellular material with a surface skin), as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: 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 optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 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, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. 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. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Porcelain enamel.
 - c. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- 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.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealant backings of type indicated 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 optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. **SEALANT A**: Control joints in interior and exterior (non-traffic) masonry. Joints in interior and exterior precast architectural concrete. Joints between interior masonry non-bearing walls or partitions and under side of floors, beams and slabs. Joints around pipes, conduits, and ducts that penetrate walls and partitions.
- B. **SEALANT B**: Expansion joints in interior tile.
- C. **SEALANT C**: Perimeter of toilet fixtures, vanities, kitchen counters, interior non-traffic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
- D. **SEALANT D**: Interior joints at the perimeter of hollow metal door frames (except at the face of hollow metal frames adjoining walls finished with wall tile, which will have grout tight to the door frames.)

END OF SECTION

SECTION 081113 – HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 M.S.U. ISSUES

- A. M.S.U. uses steel doors and frames for openings subject to repeated impact or abuse, or when appropriate to achieve required fire resistance rating
- B. Steel framing is the M.S.U. standard for all interior doorways, paired with flush wood doors. (See Division 8 section 081416 FLUSH WOOD DOORS).
- C. All public and personnel doors shall be a minimum of 36” wide to provide barrier free access for mobility aid users, U.N.O.
- D. All public and personnel doorway thresholds shall meet the latest ICC/ANSI A117.1 standards to provide barrier free access for mobility and physically impaired users.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Standard hollow-metal steel frames.
- B. Related Sections include the following:
 - 1. Division 07 Section JOINT SEALANTS for sealants used in hollow metal frame installation.
 - 2. Division 08 Section HARDWARE for door hardware for standard steel doors.
 - 3. Division 09 Section INTERIOR PAINTING for field painting standard steel doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire resistance rating and finishes for each type of steel door and frame specified.
- B. Oversize Construction Certification: For standard steel door assemblies required to be fire rated and exceeding limitations of labeled assemblies; include statement that doors comply with requirements of design, materials, and construction but have not been subjected to fire test.
- C. Qualification Data: For Installer.
- D. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- C. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.
- D. Fire-Rated Door Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
 - 1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 COORDINATION

- A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Amweld Building Products, LLC.
 - 2. Ceco Door Products; an ASSA ABLOY Group Company.

3. CURRIES Company; an ASSA ABLOY Group Company.
4. Fleming Door Products Ltd.; an ASSA ABLOY Group Company.
5. Pioneer Industries, Inc.
6. Republic Doors and Frames; a Windsor Republic Door Company
7. Steelcraft; an Ingersoll-Rand Company.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching standard steel door frames of type indicated.
- D. Grout: Comply with ASTM C 476, with a slump of 4 inches for standard steel door frames built into concrete or masonry, as measured according to ASTM C 143/C 143M.
- E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD STEEL FRAMES

- A. General: Comply with ANSI A250.8 and with details indicated for type and profile.
- B. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.
 1. Fabricate frames with mitered or coped and welded face corners.
 2. Frames for Level 2 Steel Doors and for flush wood doors 0.053-inch- thick steel sheet.
- C. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:
 1. Hinges: Minimum 0.123 inches thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 2. Lock Face Closers, and Concealed Holders: Minimum 0.067 inch thick.
 3. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.
- D. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

- E. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- F. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.
- G. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 FABRICATION

- A. General: Fabricate standard steel frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
 3. Plaster Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete, masonry or plastered walls.
 4. Where installed in masonry, leave vertical mullions in frames open at top for grouting.
 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 6. Jamb Anchors: Provide number and spacing of anchors as follows:

- a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches in height.
 - 2) Three anchors per jamb from 60 to 90 inches in height.
 - 3) Four anchors per jamb from 90 to 120 inches in height.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 120 inches in height.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches in height.
 - 2) Four anchors per jamb from 60 to 90 inches in height.
 - 3) Five anchors per jamb from 90 to 96 inches in height.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in height.
 - 5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
 - c. Compression Type: Not less than two anchors in each jamb.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
- a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- C. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section DOOR HARDWARE.
1. Reinforce frames to receive non-templated mortised and surface-mounted door hardware.
 2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

2.5 STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish standard steel frames after assembly.
- B. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- C. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.
 - 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

- C. Drill and tap frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

- B. Standard Steel Frames: Install standard steel frames for doors and other openings, of size and profile indicated. Comply with SDI 105.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

- a. At fire-protection-rated openings, install frames according to NFPA 80.
- b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
- c. Install door silencers in frames before grouting.
- d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
- e. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
- f. Apply bituminous coating to backs of all exterior frames and those that are filled with mortar, grout, and plaster containing anti freezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.

- a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry Assemblies."

4. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.

5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
8. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.
- B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

END OF SECTION

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 M.S.U. ISSUES

- A. Transparent finished wood doors and steel frames are the standard interior doors at M.S.U.
- B. All public and personnel doors shall be a minimum of 36" wide to provide barrier-free access for mobility aid users, U.N.O.
- C. It the intent of MSU that all flush wood doors used on its projects will comply with LEED™ NC 3 Credit Requirements MR Credit 4: Recycled Content, 10% (post-consumer + ½ pre-consumer), MR Credit 4: Recycled Content 20% (post-consumer + ½ pre-consumer), and EQ Credit 4.2 Low-Emitting Materials: Paints and Coatings. EQ Credit 4.2 will apply only in the instance of field finished doors.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Factory finishing flush wood doors.
 - 2. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Sections include the following:
 - 1. Division 08 Section DOOR HARDWARE for hardware for flush wood doors.
 - 2. Division 08 Section HOLLOW METAL DOORS AND FRAMES for steel frames for flush wood doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door, include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
- B. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
 - 1. Faces of Factory-Finished Doors: Show the full range of colors available for stained finishes.
- C. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.
- D. Submit printed statement and product data for field applied finishes in accordance with the General Administrative Requirements of the MSU Construction Standards 01300.1.2. Maximum VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings:
1. Clear Wood Finishes: Varnish Maximum 350 g/l, Lacquer Maximum 550 g/l
 2. Stains: Maximum 250 g/l
 3. Sealers: Waterproofing 250 g/l
 4. Sanding Sealers 275 g/l
 5. All Other Sealers 200 g/l
- E. Quality Assurance: Provide documentation as described in this section.
- 1.4 QUALITY ASSURANCE
- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 or UBC Standard 7-2, whichever is most stringent.
1. Oversize, Fire-Rated Wood Doors: For door assemblies exceeding sizes of tested assemblies, provide oversize fire door label or certificate of inspection, from a testing and inspecting agency acceptable to authorities having jurisdiction, stating that doors comply with requirements of design, materials, and construction.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with Project Number and opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Flush Wood Doors:
 - a. Algoma Hardwoods Inc.
 - b. Eggers Industries; Architectural Door Division.
 - c. GRAHAM Manufacturing Corp.
 - d. Marshfield DoorSystems.
 - e. Mohawk Flush Doors, Inc.
 - f. Oshkosh Architectural Door Co.
 - g. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Doors for Transparent Finish:
 - 1. Grade: Premium, with Grade AA faces.

2.3 SOLID-CORE DOORS

- A. Interior Veneer-Faced Doors:
 - 1. Core: Glued block or structural composite lumber.
 - 2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.
- B. Fire-Rated Doors:
 - 1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.

2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as follows:
 - a. 5-inch top-rail blocking.
 - b. 5-inch bottom-rail blocking.
 - c. 5-inch midrail blocking, in doors indicated to have exit devices.
 - d. Blocking including stile of 4 ½ inch minimum net thickness on the latch side of the door.
 - e. Stile of 1 ¼ inch minimum net thickness after trimming on the hinge side of the door.
3. Pairs: Furnish formed-steel edges and astragals for pairs of fire-rated doors, unless otherwise indicated.
 - a. Finish steel edges and astragals to match door hardware locksets or exit devices.

2.4 FABRICATION

- A. Fabricate doors in sizes indicated for Project-site fitting.
- B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
 1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.
- C. Factory machine doors for hardware that is not surface applied.
 1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

2.5 FACTORY FINISHING

- A. General: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated" for factory finishing.
- B. Transparent Finish:
 1. Grade: Premium.
 2. Finish: AWI System TR-4 Conversion Varnish.
 3. Sheen: Satin.

EXECUTION

2.6 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

2.7 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.
 - a. Comply with NFPA 80 for fire-rated doors.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
 - 3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.
- F. Field-Finished Doors: Refer to the following for finishing requirements:
 - 1. Division 09 Sections EXTERIOR PAINTING and INTERIOR PAINTING

2.8 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.

- B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 M.S.U ISSUES

- A. M.S.U. avoids access doors whenever possible by using lay-in type ceilings, but all valves and equipment requiring maintenance or adjustments will be accessible. Any door through which a person must work will be a minimum of 24" by 24".

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fire-rated ceiling access doors and frames.

1.3 SUBMITTALS

- A. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
- B. Quality Assurance: Provide documentation as described in this section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B, whichever is most restrictive, for vertical access doors.
 - 2. ASTM E 119 or UBC Standard 7.1 or UL 263, whichever is most restrictive, for horizontal access doors and frames.

1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Access Doors:

- a. Acudor Products, Inc.
- b. J. L. Industries, Inc.
- c. Karp Associates, Inc.
- d. Milcor Limited Partnership.
- e. Nystrom Building Products Co.
- f. Williams Bros. Corporation of America (The).

2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M. Electrolytic zinc-coated steel sheet, complying with ASTM A 591/A 591M, Class C coating, may be substituted at fabricator's option.
- C. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board and gypsum base for veneer plaster.
- D. Plaster Bead: Casing bead formed from 0.0299-inch zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

2.3 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

2.4 ACCESS DOORS AND FRAMES

- A. Flush, Uninsulated, Fire-Rated Access Doors and Frames with Exposed Trim: Fabricated from sheet steel.
 1. Locations: Wall surfaces.
 2. Fire-Resistance Rating: Consistent with rating of wall in which it is installed.
 3. Door: Minimum 0.060-inch-thick sheet metal, flush construction.
 4. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch-wide, surface-mounted trim.
 5. Hinges: Concealed pin type.
 6. Automatic Closer: Spring type.

7. Latch: Self-latching bolt operated by knurled knob with interior release.

2.5 FABRICATION

- A. General: Provide access door assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
 2. Provide mounting holes in frames to attach frames to metal or wood framing in plaster and drywall construction and to attach masonry anchors in masonry construction.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.7 STEEL FINISHES

- A. Surface Preparation: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
 1. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- B. Apply shop primer to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 M.S.U. ISSUES

- A. On interior doors, do not install lights that extend below the level of the top of the mounting of the exit device or the lockset.
- B. Door stops on aluminum doors should be large enough to mount strikes or electric strikes and it is preferred that they be solid. Blade stops are not permitted.
- C. At the end of a project, all unused door hardware should be provided to the M.S.U. Key Shop.
- D. When appropriate, wall magnet door holders should be provided to hold doors open during heavy usage periods to save unnecessary wear on the mechanism.
- E. Hinges on all doors that open outward (reverse bevel) shall have NRP (Non Removable Pin) hinges.
- F. A door closer is required on all doors in new or renovated computer labs (or similar spaces) which are not served by building central air conditioning and have window or room air conditioning equipment if the doors connect to non-air conditioned spaces.
- G. All public and personnel doorway hardware shall meet the latest A.D.A. - ICC/ANSI A117.1 standards to provide barrier free access for mobility and physically impaired users.
- H. Where card access controls are provided, electrified locksets or electrified panic bars shall be used instead of electric strikes. The electrified hardware shall include an RX (Request to Exit) switch.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Commercial door hardware for the following:
 - a. Swinging doors.
 - b. Other doors to the extent indicated.
- B. Related Sections include the following:
 - 1. Division 08 Section HOLLOW METAL DOORS AND FRAMES for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the frame.
 - 2. Division 08 Section FLUSH WOOD DOORS for astragals provided as part of a fire-rated labeled assembly.
 - 3. Division 08 Section ACCESS DOORS for access door hardware, except cylinders.

4. Division 08 Section AUTOMATIC ENTRANCES for entrance door hardware, except cylinders.

C. The following list is provided as a reference to clearly identify manufacturers cited in this standard:

1. Arrow Arrow Architectural Hardware; an ASSA ABLOY Group company
2. Baldwin Baldwin Hardware Corporation
3. Best Best Access Systems, Division of The Stanley Works
4. Corbin Russwin Corbin Russwin Architectural Hardware; an ASSA ABLOY Group
5. Glynn-Johnson Glynn-Johnson; an Ingersoll-Rand Company
6. Hager Hager Companies
7. Ives Ives; an Ingersoll-Rand Company
8. LCN LCN Closers; an Ingersoll-Rand Company
9. McKinney McKinney Products Company; an ASSA ABLOY Group company
10. Pemko Pemko Manufacturing Co., Inc.; an ASSA ABLOY Group company
11. Reese Reese Enterprises, Inc.
12. Rockwood Rockwood Manufacturing Company; an ASSA ABLOY Group
13. Sargent Sargent Manufacturing Company; an ASSA ABLOY Group
14. National Guard National Guard Products, Inc.
15. Von Duprin Von Duprin; an Ingersoll-Rand Company

1.3 SUBMITTALS

A. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
 - a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.

3. Content: Include the following information:

- a. Type, style, function, size, label, hand, and finish of each door hardware item.
- b. Manufacturer of each item.
- c. Fastenings and other pertinent information.
- d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
- e. Explanation of abbreviations, symbols, and codes contained in schedule.
- f. Mounting locations for door hardware.
- g. Door and frame sizes and materials.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with provisions of the following:

1. Michigan Department of Labor, Bureau of Construction Codes and Fire Safety.
2. Michigan State Police Fire Marshal Division.
 - a. Hardware furnished for labeled openings shall be labeled and have been tested by a testing laboratory recognized by the Michigan State Police Fire Marshal Division.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Each item of hardware shall be individually wrapped and packaged to avoid scratching or marking of the finishes.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

1.6 COORDINATION

- A. Coordinate layout and installation of recessed pivots and closers with floor construction. Anchoring inserts shall be cast into concrete.
- B. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.7 CYLINDERS AND KEYING

- A. All locking devices shall be supplied prepared for seven pin cylinders manufactured by Best Lock Corporation.

- B. All existing cylinders and cores will be salvaged to the M.S.U. Key Shop, unless otherwise directed.
- C. All cylinders, cores, and keys, temporary and permanent, shall be furnished by the M.S.U. Key Shop, which shall also perform the following:
 - 1. Remove existing cores and install construction cores on *existing doors* as required.
 - 2. Furnish construction cylinders, cores, and keys for *new doors*.
 - a. The contractor shall supply the M.S.U. Project Representative with a copy of the project Hardware Schedule to allow the Key Shop to match cylinders to the new hardware.
 - b. The contractor shall pick up cylinders, cores, and keys from the M.S.U. Key shop with the form "Authorization for Construction Cylinders, Cores, and Keys", completed and authorized by the M.S.U. Project Representative.
 - c. The contractor shall install construction cylinders in new doors for alignment of hardware, for use during construction, and for inspection of operation.
 - d. All construction keys issued to a contractor for a particular project will be returned to the Key Shop before final payment will be granted. Lost keys are subject to fines consisting of the cost of re-keying all locks on campus, which have the same code as the lost key.
 - e. The contractor shall tag and supply to the M.S.U. Key shop one copy of the key for each non-standard lock installed.

1.8 SCHEDULED DOOR HARDWARE

A. Hinges

- 1. Hinge locations shall conform to the National Builders Hardware Association Standards. M.S.U. avoids pivot hinges because they collect dirt and salt.
- 2. On relatively new installations and when existing conditions warrant, salvage existing hinges, clean, lubricate, and reinstall.
- 3. Electric hinges shall not be permitted.

HINGE SCHEDULE

| <u>Typical Usage</u> | <u>Quantity</u> | <u>Style</u> | <u>Manufacturer</u> |
|--|------------------------|--|---|
| Classrooms, offices, toilet rooms and storerooms of average size | 1 1/2 pair | Full mortise 4 1/2" X 4 1/2" ball bearing, standard weight, butt hinges with non-rising removable pins | McKinney Hager BB1279 or approved equal |

| | | | |
|---|---|---|---|
| Low to medium frequency use entrances and toilet rooms, and stairwell doors of high frequency use. | 1 1/2 pair | Full mortise 5" x 4 1/2" ball bearing heavyweight butt hinges with non-rising removable pins | Hager BB1168 McKinney T4B3786 or approved equal |
| Heavy doors, abused doors, or high frequency doors. Also for dormitory and stairwell doors when replacing frames. | One set, which includes one anchor and one pair butts | Full mortise 5" X 4 1/2" ball bearing, heavyweight, anchor-type hinges with non-rising removable pins, of required hand | Hager AB8505 McKinney or approved equal |
| New frames for openings with heavy weight and/or large cart traffic. Field check height of existing hinge gains when retrofitting. | 1 1/2 pair | 5" ball bearing, heavyweight, clearance hinges with non-rising removable pins | Hager BB1267 or approved equal |
| Existing frames for openings with medium weight cart traffic. Field check height of existing hinge gains when retrofitting. | 1 1/2 pair | 4 1/2 inch clearance hinges, TA-TB2895 x NRP | McKinney |
| These may be used only on existing doorframes when none of the above alternatives are appropriate, and only with the prior approval of the M.S.U. Key Shop. | | 780-210HD (surface mount) 780-224HD (mortise mount) | Hager-Roton |

B. Lock and Latch Sets – Full Mortise

1. The quality of each mortise lock set assembly, including cylinder and escutcheon, must be Grade 1 for both operation and security in accordance with ANSI A156.13 and the latest BHMA “Directory of Certified Locks and Latches.”
2. The lock set must accept Best interchangeable 7-pin tumbler cores and cylinders.
3. Locksets shall be full-mortise Corbin Russwin ML 2000 Series, with functions as listed in the lock and latch set schedule below. Knob and trim style shall be Corbin Russwin YWN trim, unless specified otherwise. Lever handle and trim style shall be Corbin Russwin NSN. Locksets shall have screwless shank and 2-3/4 inch basket.
4. Provide curved lip strike plate with tongue of appropriate length for type of door trim used.

5. Locksets on doors with card access controls shall be Sargent 8271-RX in either the WTL or LWIL trim style. All electrified locksets shall be 24 VDC.

LOCK AND LATCH SET SCHEDULE

| Typical Usage | Lock set |
|--|---|
| Use only in relatively new existing installations. Field check condition of existing locksets. | Salvage existing – clean lubricate, and reinstall. |
| Card access control door | Sargent 8271-RX-NSN |
| Classrooms, laboratories, teaching laboratories, and outside entrances with lock | Corbin Russwin ML2055 |
| Offices | Corbin Russwin ML2051 |
| Closets or passages | Corbin Russwin ML2010 |
| Janitor closets and storage rooms | Corbin Russwin ML2057 |
| Doors to roof, and from penthouse to roof two floors or less above grade and all air plenums. | Corbin Russwin ML2022, keyed both sides with abrasive knob inside |
| Mechanical rooms, transformer rooms, steam service tunnel access, telephone closets, and from public building space to roof, three floors or more above grade. M.S.U. Key Shop will modify lockset for lock cylinder and rigid knobs both sides when used from public space to roof below the third floor. | Corbin Russwin ML2057-M21, all with abrasive knob outside and free knob inside. |
| Penthouse to roof access, three floors or more above grade. | Corbin Russwin ML2057, all with abrasive knob outside and free knob inside. |
| Residence hall rooms | Corbin Russwin ML2065 YW Knob |
| Residence hall stairwells | |

| | |
|--|-------------------------------------|
| | Corbin Russwin ML2010 |
| Toilet room with single stool, and barrier-free dormitory rooms. | Corbin Russwin ML2065 |
| Barrier-free offices, used only on special request | Corbin Russwin ML2051 |
| Loading dock floors with heavy cart traffic | Rockwood trim protector bar R111LPB |

C. Exit Devices

1. Exit devices shall be rim-mounted and reversible with functions and options as listed below. Devices shall be mounted with panic bar at 37 inches above the floor with the devices undogged, or at the nearest approved manufacturer's standard.
2. **Concealed vertical rod shall not be used.**
3. Use Rockwood push plate's 70B series with all doggable exit devices.
4. All doors with card access controls shall be Von Duprin 98 Series exit devices

EXIT DEVICES SCHEDULE

| <u>Typical Usage</u> | <u>Exit Device</u> |
|---|---|
| Use only for relatively new existing installations. Field check condition of existing. | Salvage existing, clean lubricate and reinstall. |
| Rated or stairwell opening with card access control | Von Duprin RX98F with E996L Electrified Lever Trim |
| Stairwell with no lock and that cannot be dogged down | Arrow FS3808 x SL08A Von Duprin 98L-F-BE Sargent 19-12-8815 x ETL |
| Stairwell with lock, or entrance in labeled opening where device cannot be dogged down during the day | Arrow FS3808 x SL08 Von Duprin 98L-F Sargent 19-12-8813 x ETL |
| Entrance door with card access control and key override | Von Duprin RX 98 NL QEL+ |
| Entrance door with card access control and no key override | Von Duprin RX 98 DT QEL+ |
| Entrance with dogging and outside pull trim | Arrow FS3803 x SP02 |

| | |
|--|---|
| | Von Duprin 98DL Sargent 19-8810 x PTB |
| Entrance with dogging, outside pull trim and keyed cylinder | Arrow FS3803 x SL03 Von Duprin 98NL Sargent 19-12-8804 x PTB |
| Fire escapes or low occupancy classrooms with exit only requirements | Arrow FS3803 Von Duprin 98EO-F Sargent 19-12-8810 |
| Locations requiring controlled egress. | VonDuprin CHEXIT Series CX98 controlled exit device. |
| Residence hall wide stile entrance/exit doors with dogging and without cylinder | Von Duprin 98DT (pull trim and blank escutcheon) Arrow S3803 x SP02 Sargent 19-8810 x PTB |
| Residence hall wide stile entrance/exit doors with dogging and cylinder | Von Duprin 98DT (pull trim and cylinder) Arrow S3803 x SP03 Sargent 19-8804 x PTB |
| Rated opening requiring daytime passage and nighttime locking. Door is always latched. | Von Duprin 98 Series Double Cylinder Exit Device |

D. Dead Bolts

1. Dead bolts shall be full-mortise Corbin Russwin ML2200 Series with thumb turn lever 519F10 and 2 ¾ inch backset, and with functions as listed below. Unless required to match existing hardware locations or noted on drawing, center of cylinder will be at 60 inches above the finished floor.
 - a. Salvage existing dead bolts, clean lubricate and reinstall. Use only for relatively new existing installations. Field check condition of existing.
 - b. Corbin Russwin ML 2217 is typical for gang toilet rooms for use by custodial and maintenance workers.

E. Push/Pull Units

1. Push/pull plates shall be stainless steel or bronze as required for the finish desired. Pull handles shall be solid forged metal with finish specified and be through bolted through

plate and door. Punch push plate for cylinder when required by dead bolt. Unless otherwise noted, pull handles and plates shall be centered at 38 inches above the floor and push plates at 46 inches above the floor.

PUSH/PULL UNIT SCHEDULE

| | |
|-----------------------------|--|
| Salvage existing, reinstall | Use only for relatively new existing installations. Field check condition of existing. |
| Push plate | Baldwin 8" x 16" wrought push plate, 2210 or equal by Rockwood. |
| Push plate and handle | Baldwin 8" x 16" wrought pull plate 2110 with 2565 handle or equal by Rockwood. |

F. Closers

- All closers should be overhead, surface mounted closers, and must conform with ADA. **Concealed or floor closers are not acceptable. LCN Series 4040 is not acceptable.**

CLOSERS SCHEDULE

| <u>Typical Usage</u> | <u>Maximum Size Interior Door</u> | <u>Maximum Size Exterior Door</u> | <u>LCN Catalog Number</u> | <u>Corbin Russwin Catalog Number</u> |
|---|-----------------------------------|-----------------------------------|---|--------------------------------------|
| Interior doors - High Frequency: Closer mounted on <u>pull</u> side of door. | Up to 54 inches | n/a | 4011 | DC8200 |
| Interior doors - Low Frequency: Closer mounted on <u>pull</u> side of door. (offices, storage rooms, electrical, mechanical) | Up to 48 inches | n/a | 4011 | DC6200 |
| Exterior doors, or interior doors where the closer cannot be mounted on the door side of the frame. This closer mounts on the room side of the frame. It requires four inches or more clearance above the door opening. | Up to 54 inches 60 inches | Up to 42" 60 inches | 4021 4025 or 4026 sized to match door | DC8220 DC8220 |
| Exterior doors, or interior doors where the closer cannot be mounted on the door side of the frame and the mounting space on the frame is less than four inches. Design the door header to avoid this closer when possible. | Up to 54 inches 60 inches | Up to 42" 60 inches | 4021 with 18G plate 4025 or 4026 with 18G plate, sized to match door | DC8220 x 754F24 |

| | | | | |
|---|-----------|-----------|----------------------------|--------------|
| Exterior doors and interior doors - high frequency - where hold open is required. | Up to 54" | Up to 42" | 4111 w/CUSH-N-STOP x H.O. | DC86210 x A5 |
| Interior Doors – low frequency – where hold open is required (offices, storage rooms, electrical, mechanical) | Up to 48" | n/a | 4111 w/ CUSH-N-STOP x H.O. | DC6210 x A5 |

G. Doorstops

DOORSTOP SCHEDULE

| <u>Typical Usage</u> | <u>Doorstop</u> |
|---|--|
| Typical for lever handle locksets | Glynn-Johnson projected wall-mounted doorstop WB33. |
| Typical for all doors with knobs unless otherwise required by job condition | Ives wall mounted doorstop (408-1/2 at concrete or masonry, 406-1/2 at all wood and hollow walls with wood blocking, and 407-1/2 only at existing hollow walls having no blocking), or equal by Baldwin. Coordinate blocking in new walls with other trades. |
| Typical for overhead door control where there is no wall or no closer (e.g. student rooms). | Glynn Johnson 90/GJ900S |
| When using closer as a stop. | LCN door closer 4111 SHCNS (stop arm) |

H. Kick Plates

1. **Kick plates are required on the push side of all doors that have door closers.** Kick plates shall be beveled on three sides and furnished with match oval head screws.
2. Salvage existing, clean and reinstall.
3. Rockwood 304 stainless steel kick plate -.050 inch x 16" high x width of door less 1 inch. Provide higher or lower protection when noted on door schedule.
4. Rockwood bronze kick plate -.050 inch x 16" high x width of door less 1 inch. Provide higher or lower protection when noted on door schedule. Use bronze only to match existing; the bronze corrodes when the lacquer finish wears away. Provide trim protectors at high kick plates for doors with heavy cart traffic.

I. Weather-stripping

WEATHERSTRIPPING SCHEDULE

| <u>Typical Usage</u> | <u>Weather-stripping</u> |
|--|--|
| Field-check condition of existing vinyl and pile seats. Note or specify replacement as required. | Salvage existing when appropriate, clean and reinstall. |
| At both jambs and head | Pemko extruded aluminum retainer with vinyl bulb, 306A or equal by Reese. |
| Typical heavy use door bottom on new hollow metal doors. Do not use this door bottom with plastic laminated doors as insufficient material is left for screws. | Pemko full mortise automatic door bottom, 434A or equal by Reese. |
| Typical heavy use door bottom for plastic laminate doors. | Pemko semi-mortise automatic door bottom, 430AM or equal by Reese. |
| Typical heavy use door bottom for existing hollow metal doors. | Pemko surface mounted automatic door bottom, 430AS or equal by Reese. |
| Typical lighter duty door bottom for new doors. | Pemko full mortise automatic door with neoprene sponge, 411 or equal by Reese. |
| Typical lighter duty door for existing hollow metal doors. | Pemko surface mounted automatic door bottom, 412 or equal by Reese. |
| Exterior Door Sweeps Exterior Door Thresholds | National Guard C607A or Pemko 18062 National Guard 425 or Pemko 175 |

J. Foot and Head Bolts

- Foot and head bolts shall have 12-inch downset and ¾ inch throw unless otherwise noted. Manual bolts shall have lever operation which allows for partial opening before engaging bolt.

FOOT AND HEAD BOLT SCHEDULE

| <u>Typical Usage</u> | <u>Foot and Head Bolts</u> |
|---|---|
| Head bolt. Use only on non-labeled door openings. | Baldwin extension flush bolt 0610 |
| Floor bolt. Use only on non-labeled door openings. | Baldwin extension flush bolt 0610. Provide Baldwin 0621 or 0622 dustproof strike. Set floor strike in epoxy or expanding grout. Coordinate type and installation of floor strike with floor material (tile, carpet, etc.). |
| Typical at labeled door opening. Avoid pairs of doors at labeled openings if possible by using ganged single doors. | Ives FB31P. Provide strike plates for active door leaf and dustproof floor strike. Set floor strike in epoxy or expanding grout. Coordinate type and installation of floor strike with floor material (tile, carpet, etc.). |

K. Coordinators

1. Avoid door coordinators wherever possible by using removable door mullions.

DOOR COORDINATOR SCHEDULE

| <u>Typical Usage</u> | <u>Foot and Head Bolts</u> |
|---|---|
| Salvage only roller type coordinators, and only in low traffic areas. | Salvage existing. |
| Use at low traffic areas with no potential for vandalism. | Ives projected coordinator with roller operation against active and inactive doors, model 469 or 469 ½, or equal. Provide strikes and required accessories. |
| Use at high traffic openings and areas subject to vandalism. | Glynn-Johnson linear stop-mounted coordinator, Series COR, with fillers x size as required. |

L. Removable Mullion

1. Salvage existing – check anchorage.
2. Von Duprin removable steel mullion KR4954 with MT54 storage unit x prime paint, or equal by Arrow or Sargent.

M. Secret Latch

1. Rockwood RW 602x26D or Major MRS 200 SPB or MRS 200 PA(AL)

1.9 HARDWARE FINISHES

- A. Unless noted elsewhere, finish of hardware listed in Scheduled Hardware shall have Dull Bronze or Dull Chromium finish as established by the U.S. Bureau of Standards and listed in the schedule below. Items of hardware not categorized below shall have finish best matching the selected finish series.

HARDWARE FINISHES SCHEDULE

| <u>Item</u> | <u>Dull Bronze (DB) Finish Series</u> | <u>Dull Chromium (DC) Finish Series</u> |
|---|--|--|
| Hinges (All hinges shall have extra heavy copper base plating.) | US10 | US26D |
| Locksets (latch sets) | US10 | US26D |
| Panic Devices | US10 | US32D (stainless) |
| Deadbolts | US10 | US26D |
| Push/pull plates | US10 | US26D |

| | | |
|---------------------------|----------------------------------|-------------------------------|
| Doorstops | US10 | US26D |
| Kick plates | US10 | US32D or US10 |
| Vision lite glass stops | Natural Anodized Aluminum | Natural Anodized Aluminum |
| Weather-stripping | Natural Anodized Aluminum | Natural Anodized Aluminum |
| Closers | | |
| Wood | Dark Bronze | Aluminum |
| Plastic laminate | Dark Bronze | Aluminum |
| Hollow metal | Dark Bronze | Aluminum |
| Natural Anodized Aluminum | Dark Bronze | Aluminum |
| Dark Bronze Aluminum | Dark Bronze or KDP Dark if noted | Aluminum or KDP Dark if noted |

1.10 INSTALLATION

- A. Install all new and/or rework existing hardware in compliance with the manufacturer's recommendations and as noted on Door Schedule and specified herein. Mortised items will be adjusted to fit flush.
- B. Do not install surface mounted items until finishes have been completed on the substrates involved.
- C. Lubricate and adjust all hardware to operate properly.

Hardware Group No. 01

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|----------------------------|--------------------------------------|--------|-----|
| 1 | EA | DOOR CORD | 798-18 LESS WIRES | ⚡ 626 | SCE |
| 1 | EA | ELEC FIRE EXIT HARDWARE | RX-QEL-98-L-NL-F-06 24 VDC | ⚡ 626 | VON |
| 1 | EA | CYLINDER | (PROVIDED BY OWNER) | 626 | |
| 1 | EA | SURF. AUTO OPERATOR | 4822 WMS | ⚡ 689 | LCN |
| 1 | EA | CONTROL BOX | 7902SES | ⚡ | LCN |
| 50 | FT | PNEUMATIC TUBING | 925 | | LCN |
| 2 | EA | ACTUATOR | OPTI-TOUCH | ⚡ | |
| 1 | EA | ACCESS CONTROL | (BY SECURITY CONTRACTOR) | ⚡ | |
| 1 | EA | DOOR CONTACT | (BY OWNER) | ⚡ | |
| | | | (RE-USE BALANCE OF EXISTING HDWE) | | |

PRESENTING AN AUTHORIZED CREDENTIAL WILL RETRACT THE EXIT DEVICE LATCHBOLT TO ALLOW ACCESS. FREE EGRESS IS ALWAYS ALLOWED. COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT, AND ALL RELATED TRADES.

Hardware Group No. 02

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|---------------------|--------------------------------------|--------|-----|
| 1 | EA | SURF. AUTO OPERATOR | 4822 WMS | ⚡ 689 | LCN |
| 1 | EA | CONTROL BOX | 7902SES | ⚡ | LCN |
| 50 | FT | PNEUMATIC TUBING | 925 | | LCN |
| 2 | EA | ACTUATOR | OPTI-TOUCH | ⚡ | |
| | | | (RE-USE BALANCE OF EXISTING HDWE) | | |

COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT AND ALL RELATED TRADES.

Hardware Group No. 03

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|--------------------|-----------------------------------|--------|-----|
| 1 | EA | DOOR CORD | 798-18 LESS WIRES | ↗ 626 | SCE |
| 1 | EA | FIRE EXIT HARDWARE | 98-L-F-E996-06-FS | ↗ 626 | VON |
| 1 | EA | CYLINDER | (PROVIDED BY OWNER) | 626 | |
| 1 | EA | ACCESS CONTROL | (BY SECURITY CONTRACTOR) | ↗ | |
| 1 | EA | DOOR CONTACT | (BY OWNER) | ↗ | |
| | | | (RE-USE BALANCE OF EXISTING HDWE) | | |

PRESENTING AN AUTHORIZED CREDENTIAL WILL UNLOCK LEVER TRIM TO ALLOW ACCESS. FREE EGRESS IS ALWAYS ALLOWED.
 COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT AND ALL RELATED TRADES.

Hardware Group No. 04

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|----------------|----------------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | STOREROOM LOCK | ML2057 LC NSN | 626 | C-R |
| 1 | EA | CYLINDER | (PROVIDED BY OWNER) | 626 | |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 1 1/2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS33(X) | 626 | IVE |

Hardware Group No. 05

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|----------------|----------------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | DORMITORY LOCK | ML2065 LC NSN V04 | 626 | C-R |
| 1 | EA | CYLINDER | (PROVIDED BY OWNER) | 626 | |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 1 1/2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS33(X) | 626 | IVE |

Hardware Group No. 06

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|----------------|----------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | STOREROOM LOCK | ML2057 LC NSN | 626 | C-R |
| 1 | EA | WALL STOP | WS33(X) | 626 | IVE |

Hardware Group No. 07

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|----------------|----------------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | STOREROOM LOCK | ML2057 LC NSN | 626 | C-R |
| 1 | EA | CYLINDER | (PROVIDED BY OWNER) | 626 | |
| 1 | EA | SURFACE CLOSER | 4111 CUSH | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 1 1/2" LDW B-CS | 630 | IVE |

Hardware Group No. 08

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|-------------|----------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | PRIVACY SET | ML2060 NSN V10 | 626 | C-R |
| 1 | EA | WALL STOP | WS33(X) | 626 | IVE |

Hardware Group No. 09

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|----------------|----------------------------|--------|-----|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | CLASSROOM LOCK | ML2055 LC NSN | 626 | C-R |
| 1 | EA | CYLINDER | (PROVIDED BY OWNER) | 626 | |
| 1 | EA | OH STOP | 90S | 652 | GLY |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 1 1/2" LDW B-CS | 630 | IVE |

Hardware Group No. 10

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|------------------|----------------------------|--------|-----|
| 2 | EA | HINGE | 5BB1HW 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | ELECTRIC HINGE | 5BB1HW 4.5 X 4.5 CON TW4 | ⚡ 652 | IVE |
| 1 | EA | RECEIVER | SK-910RBQ | ⚡ BLK | SEC |
| 1 | EA | TRANSMITTER | SK-917T2-GNQ | ⚡ BLK | SEC |
| 1 | EA | MLR MORTISE LOCK | Z7652 R EE | ⚡ 626 | SDC |
| 1 | EA | CYLINDER | (PROVIDED BY OWNER) | 626 | |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 1 1/2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS33(X) | 626 | IVE |

COORDINATE WITH THE OWNER, THE ARCHITECT AND ALL RELATED TRADES.

END OF SECTION

SECTION 088300 – MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following types of silvered flat glass mirrors:
 - 1. Annealed monolithic glass mirrors.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.
- C. Samples:
 - 1. Mirrors: 12 inches (300 mm) square, including edge treatment on two adjoining edges.
 - 2. Mirror Clips: Full size.
 - 3. Mirror Trim: 12 inches (300 mm) long.

1.3 QUALITY ASSURANCE

- A. Glazing Publications: Comply with GANA's "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- B. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing and substrates on which mirrors are installed.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 - 1. Warranty Period: 15 years from date of Substantial Completion, manufacture.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

- A. Glass Mirrors, General: ASTM C 1503.
 - 1. Manufacturer: American Specialties

- a. Model No: 0600
- b. Size: As noted on drawings.

B. Clear Glass: Mirror Select Quality.

- 1. Nominal Thickness: 6.0 mm.

2.2 MISCELLANEOUS MATERIALS

A. Edge Sealer: Approved by mirror manufacturer.

B. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.3 FABRICATION

A. Mirror Edge Treatment: Flat polished. Seal edges of mirrors with edge sealer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

- 1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
- 2. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

B. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

C. Wall-Mounted Mirrors: Install mirrors with hanger strap and tamperproof mounting and locking screws.

D. Protect mirrors from breakage and contaminating substances resulting from construction operations.

E. Do not permit edges of mirrors to be exposed to standing water.

F. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

- G. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION

SECTION 092613 - GYPSUM VENEER PLASTERING

PART 1 - GENERAL

1.1 M.S.U. ISSUES

- A. It is the intent of MSU that all gypsum veneer plaster used on its projects will comply with LEED™ NC 3 Credit Requirements MR Credit 4.1: Adhesives and Sealants.
- B. All gypsum board products will be applied ½” above floor level to minimize potential mold growth, unless gypsum board is required by fire rating to be installed to floor level.
- C. Patched openings in plaster construction shall be re-framed and lathed in as required to maintain original plaster thickness. Areas or openings to be patched shall have the existing finish coat chipped back one inch away from joint down to brown coat or base coat as required to overlap and bond new plaster patch to existing plaster. Areas to be patched or tied into shall be primed with an approved latex bonding agent in accordance with manufacturer’s recommendations.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Gypsum veneer plaster and gypsum base for veneer plaster.
 - 2. Cementitious backer units for tile backing panels.
 - 3. Non-load-bearing steel framing.

1.3 DEFINITIONS

- A. Terminology: Refer to ASTM C 11 for definitions of terms for gypsum veneer plaster assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Submit printed VOC statement and product data for acoustical sealants and laminating adhesives in accordance with the General Administrative Requirements of the MSU Construction Standards 01300.1.2. Maximum VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, effective July 1, 2005 and amended January 7, 2005:
 - 1. Acoustical Sealants for Exposed and Concealed Joints 250 g/l
 - 2. Auxiliary Materials/Laminating Adhesives 50 g/l

1.5 QUALITY ASSURANCE

- A. Source Limitations for Gypsum Veneer Plaster Products: Obtain gypsum veneer plaster products, including gypsum base, joint reinforcing tape, embedding material, and plasters, from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
 - 1. Gypsum Base for Veneer Plaster: Stack panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 843 requirements or gypsum veneer plaster manufacturer's written recommendations, whichever are more stringent.
- B. Room Temperatures: Maintain not less than 55 deg F or more than 80 deg F for 7 days before application of gypsum base and gypsum veneer plaster, continuously during application, and after application until veneer plaster is dry.
- C. Avoid conditions that result in gypsum veneer plaster drying too rapidly.
 - 1. Distribute heat evenly; prevent concentrated or uneven heat on veneer plaster.
 - 2. Maintain relative humidity levels for prevailing ambient temperature that produces normal drying conditions.
 - 3. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during veneer plaster application and until it is dry.

PART 2 - PRODUCTS

2.1 STEEL FRAMING, GENERAL

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Dale Industries, Inc. - Dale/Incor.
 - 2. Dietrich Industries, Inc.
 - 3. Clark Steel Framing Systems.
 - 4. Unimast, Inc.
- B. Steel Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: G60, hot-dip galvanized zinc coating,

2.2 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.
- B. Hanger Attachments to Concrete:
 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
 1. Depth: 1-1/2 inches.
- F. Furring Channels (Furring Members):
 1. Cold-Rolled Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 2. Steel Studs: ASTM C 645.
 - a. Minimum Base Metal Thickness: 0.0312 inch.
 - b. Depth: 3-5/8 inches.
 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base Metal Thickness: 0.0312 inch]
- G. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
 - b. Chicago Metallic Corporation; Fire Front 630, Drywall Furring 640, Fire Front 650, Drywall Furring 660, Fire Front 670 System.

- c. USG Interiors, Inc.; Drywall Suspension System.

2.3 STEEL PARTITION AND SOFFIT FRAMING

- A. Steel Studs and Runners: ASTM C 645.
 - 1. Minimum Base Metal Thickness: 0.0312 inch.
 - 2. Depth: 3-5/8 inches for ceiling heights up to 10 feet, and 6 inches for heights over 10 feet.
- B. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base Metal Thickness: 0.0312 inch.
 - 2. Depth: 7/8 inch].
- C. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
- D. Cold-Rolled Furring Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: 3/4 inch.
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0312 inch.
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.
- E. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.
- F. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.4 GYPSUM VENEER PLASTER MATERIALS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Two-Component Gypsum Veneer Plaster:
 - a. United States Gypsum Co.:
 - 1) High-Strength Base Coat: IMPERIAL Basecoat Plaster.
 - 2) High-Strength, Smooth Finish Coat: IMPERIAL Finish Plaster

- B. Two-Component Gypsum Veneer Plaster: Separate formulations complying with ASTM C 587; one for base coat and one for finish coat application over substrates indicated.
 - 1. High-Strength Base Coat: Ready-mixed, base-coat plaster containing mill-mixed, fine silica sand; with a compressive strength of 3000 psi when tested according to ASTM C 472.
 - 2. High-Strength Finish Coat: Ready-mixed, smooth, finish-coat veneer plaster containing mill-mixed, fine silica sand; with a compressive strength of 3000 psi when tested according to ASTM C 472.
 - 3. Provide ready-mixed or job-sanded mix components, as standard for manufacturer, to comply with manufacturer's written recommendations.

2.5 PANEL PRODUCTS

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Gypsum Base for Veneer Plaster: ASTM C 588 and products of same manufacturer as plaster.
 - 1. Regular Type: 1/2 inch thick, unless otherwise indicated.
 - a. Location: Vertical and ceiling surfaces, unless otherwise indicated.
- C. Cementitious Backer Units: ANSI A118.9, 1/2 inch thick.
 - 1. Location: Tile substrates, unless otherwise indicated.
 - 2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Custom Building Products; Wonderboard.
 - b. United States Gypsum Co.; DUROCK Cement Board.
 - c. National Gypsum Company; PermaBase.

2.6 TRIM ACCESSORIES

- A. Standard Trim: ASTM C 1047, provided or approved by manufacturer for use in gypsum veneer plaster applications indicated.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead: Use at outside corners, unless otherwise indicated.
 - b. Expansion (Control) Joint: Use where indicated.

2.7 JOINT REINFORCING MATERIALS

- A. General: Comply with joint strength requirements in ASTM C 587 and with gypsum veneer plaster manufacturer's written recommendations for each application indicated.
- B. Joint Tape:
 - 1. Gypsum Base for Veneer Plaster. Open-mesh, glass fiber.
 - 2. Cementitious Backer Units: As recommended by cementitious backer unit manufacturer.
- C. Embedding Material for Joint Tape:
 - 1. Gypsum Base for Veneer Plaster: Material produced and recommended by gypsum veneer plaster manufacturer for use with joint tape material and gypsum veneer plaster applications indicated.
 - 2. Cementitious Backer Units: Material recommended by cementitious backer unit manufacturer for applications indicated.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

2.9 GYPSUM VENEER PLASTER MIXES

- A. Mechanically mix gypsum veneer plaster materials to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Installation Standards: ASTM C 754, and ASTM C 844 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum veneer plaster assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum veneer plaster manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
 - 1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
 - 2. Isolate partition framing and wall furring where they abut structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assemblies and laterally support assemblies.
- D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Suspend ceiling hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
 - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 6. Do not attach hangers to steel deck tabs.
 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member and transversely between parallel members.
- C. Screw furring to wood framing.
- D. Wire tie or clip furring channels to supports.
- E. Install suspended steel framing components in sizes and spacings indicated, but not less than those required by referenced steel framing and installation standards.
1. Hangers: 48 inches o.c.
 2. Carrying Channels (Main Runners): 48 inches o.c.
 3. Furring Channels (Furring Members): 16 inches o.c.
- F. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

- A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum veneer plaster assemblies abut other construction.
- B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum base panels.
- D. Install steel studs and furring at the following spacings:
1. Single-Layer Construction: 16 inches o.c., unless otherwise indicated.
 2. Cementitious Backer Units: 16 inches o.c., unless otherwise indicated.
- E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.

- F. Frame door openings to comply with GA-600 and with gypsum veneer plaster manufacturer's written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - 1. Install two studs at each jamb, unless otherwise indicated.
 - 2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint.
 - 3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- G. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

3.6 APPLYING PANELS, GENERAL

- A. Gypsum Base for Veneer Plaster: Apply according to ASTM C 844, unless manufacturer's written recommendations are more stringent.
 - 1. Do not allow gypsum base to fade from exposure to light.
 - 2. Erection Tolerance: No more than 1/16-inch offsets between planes of gypsum base faces, and 1/8 inch in 8 feet for level, plumb, warp, and bow.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Attach panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- F. Attach panels to framing provided at openings and cutouts.
- G. Do not attach panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.
- H. Form control and expansion joints with space between edges of adjoining panels.

- I. Cover both faces of steel stud partition framing with panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- J. Isolate perimeter of non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with metal edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- K. Floating Construction: Where feasible, including where recommended in writing by manufacturer, install panels over wood framing, with floating internal corner construction.
- L. Fastener Spacing: According to referenced gypsum base for gypsum veneer plaster application standard, manufacturer's written recommendations, and fire-resistance-rating requirements.
 - 1. Space screws a maximum of 12 inches o.c. for vertical applications.
 - 2. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

3.7 PANEL APPLICATION METHODS

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum base panels before wall/partition panels to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum base panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
- B. Single-Layer Fastening Methods: Apply gypsum base panels to supports with steel drill screws.
- C. Cementitious Backer Units: Install according to ANSI A108.11.
 - 1. Where cementitious backer units abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.8 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 844 and in specific locations approved by Architect for visual effect.

3.9 INSTALLING JOINT REINFORCEMENT

- A. Gypsum Base for Veneer Plaster: Reinforce interior angles and flat joints with joint tape and embedding material to comply with ASTM C 843 and gypsum veneer plaster manufacturer's written recommendations.
- B. Cementitious Backer Units: Reinforce joints between cementitious backer units with joint tape and embedding material according to unit manufacturer's written recommendations.

3.10 GYPSUM VENEER PLASTERING

- A. Gypsum Veneer Plaster Application: Comply with ASTM C 843 and veneer plaster manufacturer's written recommendations.
 - 1. Where gypsum veneer plaster abuts metal door frames, windows, and other units in veneer plaster, groove finish coat to eliminate spalling.
- B. Concealed Surfaces: Omit gypsum veneer plaster in the following areas where veneer plaster will be concealed from view in the completed Work, unless otherwise indicated or required to maintain fire-resistance rating. Do not omit veneer plaster behind cabinets, furniture, furnishings, and similar removable items.
 - 1. Above suspended ceilings.
 - 2. Behind wood paneling and other permanently applied wall or ceiling finishes.
- C. Gypsum Veneer Plaster Finish: Smooth-troweled finish, unless otherwise indicated.

END OF SECTION

SECTION 093013 – CERAMIC TILING

PART 1 - GENERAL

1.1 M.S.U. ISSUES

- A. Typical locations for dry area ceramic tile installation include areas subject to heavy traffic, such as entrance lobbies and main hallways, where impermeability, stain and water resistance, and easy cleaning are foremost requirements. For installation of ceramic tile in areas where usage or anticipated cleaning process calls for waterproof installation, refer to Section 093400 – WATERPROOFING MEMBRANE TILING.
- B. When installing tile as part of rehabilitation or repair of existing tiled surfaces, match existing type, texture, size, thickness, edge shapes and variations in color. Submit samples for selection.
- C. When a tile system is installed, M.S.U. will expect a special warranty as follows:
 - 1. Warranty must be provided by the setting materials manufacturer and shall cover the complete flooring system, including all labor and materials. Warranty period shall be for a period of five years from date of installation, and shall warrant the installed assembly to be free from manufacturing and installation defects.
 - 2. During the warranty period, M.S.U will require defective work to be restored to the standard of the Contract Documents, including labor and materials and other costs incidental to the Work. Within 24 hours after receipt of notice from the Owner, the Work must be inspected. Work found defective as defined in the contract documents will be restored within 10 days after receipt of notice from the owner.
- D. It is the intent of MSU that all ceramic tile installation used on its projects will comply with LEED™ NC 3 Credit Requirements MR Credit 4.1: Adhesives and Sealants.
- E. It is the intent of MSU that all ceramic tile, materials, and methods of installation shall meet the latest ICC/ANSI A117.1 standards for slip resistance and provide barrier free access for mobility and physically impaired users.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Floor tile
 - 2. Wall tile
 - 3. Crack-suppression membrane for thin-set tile installations.
 - 4. Metal edge strips installed as part of tile installations.
- B. Related Sections include the following:
 - 1. Division 03 Section CAST-IN-PLACE CONCRETE for monolithic slab finishes specified for tile substrates.

2. Division 07 Section JOINT SEALANTS for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
3. Division 09 Section GYPSUM VENEER PLASTERING for cementitious backer units.
4. Division 09 Section PORTLAND CEMENT PLASTERING for portland cement scratch coat over metal lath on wall surfaces.
5. Division 09 Section WATERPROOFING MEMBRANE TILING for tile installation in swimming pools, showers, toilets, kitchens, or surgeries where usage or anticipated cleaning process calls for waterproof installation.

1.3 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 1. Level Surfaces: Minimum 0.6.
 2. Step Treads: Minimum 0.6.
 3. Ramp Surfaces: Minimum 0.8.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: If requested, show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Projects involving replacement of existing tile floors will be mapped as specified in this Section, and the resulting document submitted to the Project Representative prior to demolition of the old floor.
- D. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- E. Samples for Verification, if requested:
 1. Full-size units of each type and composition of tile and for each color and finish required.
 2. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
 3. Full-size units of each type of trim and accessory for each color and finish required.
 4. Stone thresholds in 6-inch lengths.
 5. Metal edge strips in 6-inch lengths.
- F. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- G. Product Certificates: For each type of product.

- H. Qualification Data: For Installer. Provide documentation that the installer is approved or licensed by the setting bed manufacturer and demonstrating experience with the floor system being installed.
- I. Material Test Reports: For each tile-setting and -grouting product.
- J. Maintenance instruction for each type of tile.
- K. Provide extra tile for future replacement of damaged tile. The type and amount should be verified with the M.S.U. Project Manager.
- L. Submit printed VOC statement and product data for adhesives, grout and sealant in accordance with the General Administrative Requirements of the MSU Construction Standards 01300.1.2. Maximum VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, effective July 1, 2005 and amended January 7, 2005:
 - 1. Adhesives 65 g/l
 - 2. Epoxy Grouts 65 g/l
 - 3. Elastometric Sealants 250 g/l
- M. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
 - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer. Grout, setting bed, and underlayments shall be by the same manufacturer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
 - 1. Joint sealants.
 - 2. Metal edge strips.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store liquid latexes in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- C. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. CT-1: Stonepeak

B. CT-2: Stonepeak

C. Crack Suppression Membrane:

- 1. Fabric reinforced two-part liquid rubber membrane to provide crack bridging over concrete shrinkage cracks and other non-structural cracks.
- 2. Products:
 - a. LATICRETE International Inc., Laticrete Blue 92 Anti-Fracture Membrane.
 - b. MAPEI Corporation, Mapelastic L.

- c. MER-KRETE Systems, Hydrosshield 6000.
- d. Or approved equal.

D. Thin Setting Mortar:

1. Manufactured graded sand aggregate and Portland cement, and acrylic latex admixture exceeding ANSI A118.4.
2. Products:
 - a. LATICRETE International Inc., Laticrete 272 & 3701.
 - b. MAPEI Corporation, Keralastic with Kerabond.
 - c. MER-KRETE Systems, Mer-Krete 720 with Mer-Krete 150 Acrylic/Latex.
 - d. Or approved equal.

E. Waterproofing membrane:

1. If indicated, see Section 093400 – WATERPROOFING-MEMBRANE TILING.

F. Grout:

1. 100% solid epoxy grout exceeding ANSI A118.3, chemical resistant and water cleanable.
2. Products:
 - a. LATICRETE International Inc., Latipoxy.
 - b. MAPEI Corporation, Kerapoxy.
 - c. MER-KRETE Systems, Mer-Poxy.
 - d. Or approved equal.

2.3 WALL SYSTEM:

A. Portland Cement Mortar Base:

1. Use at existing walls and irregular wall conditions.
2. Products:
 - a. 2 parts graded sand to 1 part Portland cement.
 - b. MAPEI Corporation – Scratch Coat Mortar
 - c. Or approved equal.
3. Expanded metal lath: Provide diamond mesh lath complying with ASTM C847 for requirements as follows:
 - a. Fabricate lath from zinc-coated steel sheet
 - b. Self-furring.
 - c. Weight: $\frac{3}{4}$ lb/sq. ft.
4. Cleavage Membrane: Asphalt felt – 15 lb., ASTM D226, Type I.
5. Vapor Barrier: 6-mil polyethylene sheeting.

B. Thin Setting Mortars

1. Use at new walls and other clean concrete surfaces (same as for floor systems.)
2. Manufactured graded sand aggregate and Portland cement, and acrylic/latex admixture exceeding ANSI A118.4.
3. Products:
 - a. LATICRETE International Inc., Laticrete 272 & 3701.
 - b. MAPEI Corporation, Mapecem Premix & Planicrete AC.
 - c. MER-KRETE Systems, Mer-Krete 720 with Mer-Krete 150 Acrylic/Latex.
 - d. Or approved equal.
4. When installing new tile over the ground masonry surface of old wall tile, use a rubber based setting adhesive.

C. Waterproofing membrane:

1. If indicated, see Section 093400 – WATERPROOFING-MEMBRANE TILING.

D. Grout.

1. 100% solid epoxy grout exceeding ANSI A118.3, chemical resistant and water cleanable.
2. Products:
 - a. LATICRETE International Inc., Latipoxy.
 - b. MAPEI Corporation, Kerapoxy.
 - c. MER-KRETE Systems, Mer-Poxy.
 - d. Or approved equal.

2.4 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- C. For non-traffic surfaces provide One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
 1. Available Products:
 - a. Dow; DOWSIL 786 Silicone Sealant - M
 - b. GE Silicones; Sanitary 1700.
 - c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.

d. Tremco, Inc.; Tremsil 600 White.

- D. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout. Include primer and backer rod recommended by manufacturer.
- E. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout. Include primer and backer rod recommended by manufacturer.

2.5 MISCELLANEOUS MATERIALS

- A. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic base, designed specifically for flooring applications, stainless steel; ASTM A 666, 300 Series exposed-edge material.
1. Products:
- a. Schluter Systems DILEX_AKWS.
 - b. Or approved equal.
- B. Control Joints: Aluminum legs and flanges with thermoplastic rubber movement zone.
1. Products:
- a. Schluter Systems DILEX-AKWS.
 - b. Or approved equal.
- C. Temporary Protective Coating: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- D. Tile Cleaner: A cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers. Emene cleaners will be used sparingly as approved by the setting bed manufacturer. These cleaners will be used as soon after installation as practical to make cleaning easier.

2.6 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile have been completed before installing tile.
 - 3. Installer shall map out all existing cracks in existing floor finishes before demolition begins so that the structural slab can be examined and investigated for the cause of such tracing in the mapped locations after demolition is complete.
 - 4. To preclude an unacceptable level of moisture in or being emitted from substrates, verify that substrate is acceptable for installation of setting bed and tile as determined by respective manufacturer's moisture testing procedure for concrete slabs or other substrates.
 - 5. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
 - 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.

2. Remove protrusions, bumps, and ridges by sanding or grinding.
 3. On renovation projects where existing setting bed material is being removed, no soft or unbonded or otherwise unsound material will be left in place.
- C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.
- E. Protect the work and adjacent construction against damage during progress of the work until completion.

3.3 INSTALLATION, GENERAL

- A. Install wall tile first, then floor tile. Start installation of the wall tile at the lowest point of floor slopes so that the grout joint between wall tile and floor tile will be on the horizontal surface.
- B. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- C. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Unless otherwise specified, comply with TCA installation methods indicated in ceramic tile installation schedules.
- D. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- E. Avoid laying patterns of accent tiles near adjacent walls that would accent wall irregularities.
- F. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- G. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
- H. Lay out tile wainscots to next full tile beyond dimensions indicated.

- I. Expansion Joints: Locate expansion joints and other joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
- J. Grout tile to comply with requirements of the following tile installation standards:
 - 1. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

3.4 CRACK-SUPPRESSION MEMBRANE INSTALLATION

- A. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

3.5 FLOOR TILE INSTALLATION

- 1. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.
 - a. Tile floors composed of tiles 8 by 8 inches or larger.
- B. With the approval of the project representative that the structural slab is ready for new work, repair or prepare all cracks with the appropriate method.
- C. Joint Widths: Install tile on floors with the following joint widths unless otherwise indicated:
 - 1. Ceramic Mosaic Tile: 1/16 inch.
 - 2. Porcelain Ceramic Tile: 1/8 inch.
- D. Stone Thresholds: Install stone thresholds set in same type of setting bed as abutting field tile, unless otherwise indicated.
- E. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.6 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- B. Set tile in a bond coat of latex Portland cement mortar in compliance with ANSI A108.5 and mortar manufacturer's instructions.
- C. Where wall substrate irregularities exceed ¼" in 8 feet, apply a leveling bed.
 - 1. Clean and roughen wall surfaces as require to thoroughly bond leveling bed.

2. Apply mortar to required thickness and carefully screed surface to true, accurate plane. Cure under vaporproof membrane or other approved method for not less than 3 days before installing tile.

D. Joint Widths: Install tile on walls with the following joint widths unless otherwise indicated:

1. Ceramic Mosaic Tile: 1/16 inch.
2. Porcelain Ceramic Tile: 1/8 inch.

3.7 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Post suitable notices to prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Protect waterproof membrane prior to and during the installation.

E. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

F. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. No other trades will work on tile floors until epoxy grout is fully cured and cleaned from the surface of the tile.

END OF SECTION 093013

SECTION 093400 – WATERPROOFING-MEMBRANE TILING

PART 1 - GENERAL

1.1 M.S.U. ISSUES

- A. Typical locations for dry area ceramic tile installation include areas subject to heavy traffic, such as entrance lobbies and main hallways, where impermeability, stain and water resistance, and easy cleaning are foremost requirements. For installation of ceramic tile in areas where usage or anticipated cleaning process calls for waterproof installation, refer to Section 093400 – WATERPROOFING MEMBRANE TILING.
- B. When a tile system is installed, M.S.U. will expect a special warranty as follows:
 - 1. Warranty must be provided by the setting materials manufacturer and shall cover the complete flooring system, including all labor and materials. Warranty period shall be for a period of five years from date of installation, and shall warrant the installed assembly to be free from manufacturing and installation defects.
 - 2. During the warranty period, M.S.U will require defective work to be restored to the standard of the Contract Documents, including labor and materials and other costs incidental to the Work. Within 24 hours after receipt of notice from the Owner, the Work must be inspected. Work found defective as defined in the contract documents will be restored within 10 days after receipt of notice from the owner.
- C. It is the intent of MSU that all ceramic tile installation used on its projects will comply with LEED™ NC 3 Credit Requirements MR Credit 4.1: Adhesives and Sealants.
- D. It is the intent of MSU that all ceramic tile, materials, and methods of installation shall meet the latest ICC/ANSI A117.1 standards for slip resistance and provide barrier free access for mobility and physically impaired users.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Glazed wall tile
 - 2. Paver tile.
 - 3. Crack-suppression membrane for thin-set tile installations.
 - 4. Metal edge strips installed as part of tile installations.
- B. Related Sections include the following:
 - 1. Division 07 Section JOINT SEALANTS for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

2. Division 09 Section WATERPROOFING MEMBRANE TILING for tile installation in swimming pools, showers, toilets, kitchens, or surgeries where usage or anticipated cleaning process calls for waterproof installation.

1.3 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 1. Level Surfaces: Minimum 0.6.
 2. Step Treads: Minimum 0.6.
 3. Ramp Surfaces: Minimum 0.8.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: If requested, show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Projects involving replacement of existing tile floors will be mapped as specified in this Section, and the resulting document submitted to the Project Representative prior to demolition of the old floor.
- D. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- E. Samples for Verification, if requested:
 1. Full-size units of each type and composition of tile and for each color and finish required.
 2. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
 3. Full-size units of each type of trim and accessory for each color and finish required.
 4. Stone thresholds in 6-inch lengths.
 5. Metal edge strips in 6-inch lengths.
- F. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- G. Product Certificates: For each type of product.

- H. Qualification Data: For Installer. Provide documentation that the installer is approved or licensed by the setting bed manufacturer and demonstrating experience with the floor system being installed.
- I. Material Test Reports: For each tile-setting and -grouting product.
- J. Maintenance instruction for each type of tile.
- K. Provide extra tile for future replacement of damaged tile. The type and amount should be verified with the M.S.U. Project Manager.
- L. Submit printed VOC statement and product data for adhesives, grout and sealant in accordance with the General Administrative Requirements of the MSU Construction Standards 01300.1.2. Maximum VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, effective July 1, 2005 and amended January 7, 2005:
 - 1. Adhesives 65 g/l
 - 2. Epoxy Grouts 65 g/l
 - 3. Elastometric Sealants 250 g/l
- M. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
 - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer. Grout, setting bed, and underlayments shall be by the same manufacturer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
 - 1. Joint sealants.
 - 2. Metal edge strips.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store liquid latexes in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- C. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

- A. Tile will be solid body porcelain ceramic. If larger format tile than 6x6 is used at areas with new or existing floor drains, dimension and jointing /cut pattern must be considered in advance to accommodate the required slope to drains – typically 1/8” per foot minimum. Verify slope requirements and drain placement per specific project. Avoid glazed or textured floor tile in all but lowest traffic situation installation.
 - 1. Porcelain Tile (CT-1):
 - a. Manufacturer: Daltile.
 - b. Product: Linden Point .
 - c. Size: 10” x 14” flat edge.

- d. Color: Grigio LP21.
2. Porcelain Tile (CT-2):
 - a. Manufacturer: Daltile.
 - b. Product: Subway Tile
 - c. Size: 4" x 8".
 - d. Color: Arctic White 0190
- B. Glazed Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
 1. External Corners for Portland Cement Mortar Installations: Bullnose shape with radius of at least 3/4 inch, unless otherwise indicated.
 2. External Corners for Thin-Set Mortar Installations: Surface bullnose.
 3. Internal Corners: Field-buttet square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.

2.3 FLOOR SYTEM

A. UNDERLAYMENTS

1. Thin Mortar Bed Underlayments (0 to 3/4" thick).
 - a. Thin underlayments will be factory pre-blended mixes of graded sand aggregates, Portland cement, and an acrylic/latex admixture. Products will be designed for the thickness to be installed. These products will also be used as a mortar bed on top of the membrane around floor drains and other areas that may require additional grading.
 - b. Products:
 - 1) LATACRETE International Inc., Latacrete 226 & 3701.
 - 2) MAPEI Corporation, Mapecem Premix and Planicrete AC.
 - 3) MER-KRETE Systems: Underlay-L or Underlay M.
 - 4) Or approved equal.
2. Thick Mortar Bed Underlayment (greater than 3/4" thick).
 - a. These materials may be the same as the thin mortar bed underlayment materials above, or site mixed of graded sand, Portland cement, and an acrylic/latex admixture. Mixture shall exceed the following properties:

- | | | |
|----|-------------------------------|----------|
| 1) | Compressive Strength/ASTM 190 | 4500 psi |
| 2) | Tensile Strength/ASTM 190 | 350 psi |
| 3) | Flexural Strength/ASTM C348 | 1800 psi |
| 4) | Shear Bond Strength | 470 psi |

B. Crack Suppression Membrane:

1. Fabric reinforced two-part liquid rubber membrane to provide crack bridging over concrete shrinkage cracks and other non-structural cracks.
2. Products:
 - a. LATICRETE International Inc., Laticrete Blue 92 Anti-Fracture Membrane.
 - b. MAPEI Corporation, Mapelastic L.
 - c. MER-KRETE Systems, Hydrosield 6000.
 - d. Or approved equal.

C. Thin Setting Mortar:

1. Manufactured graded sand aggregate and Portland cement, and acrylic latex admixture exceeding ANSI A118.4.
2. Products:
 - a. LATICRETE International Inc., Laticrete 272 & 3701.
 - b. MAPEI Corporation, Keralastic with Kerabond.
 - c. MER-KRETE Systems, Mer-Krete 720 with Mer-Krete 150 Acrylic/Latex.
 - d. Or approved equal.

D. Waterproofing membrane:

1. Required on shower stall walls from floor to ceiling.
2. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber and fabric reinforcement. The product will be a trowel or roller applied thin load-bearing membrane exceeding ANSI A118.10. Membrane will accommodate minor substrate movement and provide a crack isolation membrane. Membrane will be fabric reinforced at all changes in plane.
3. Products:
 - a. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.

- b. MAPEI Corporation; Mapelastic L.
- c. MER-KRETE Systems, Hydrosield 6000.
- d. Or approved equal.

E. Grout:

- 1. 100% solid epoxy grout exceeding ANSI A118.3, chemical resistant and water cleanable.
- 2. Products:
 - a. MAPEI Corporation, Kerapoxy.
 - 1) Color: 19 Pearl Gray.

2.4 WALL SYSTEM:

A. Portland Cement Mortar Base:

- 1. Use at existing walls and irregular wall conditions.
- 2. Products:
 - a. 2 parts graded sand to 1 part Portland cement.
 - b. MAPEI Corporation – Scratch Coat Mortar
 - c. Or approved equal.
- 3. Expanded metal lath: Provide diamond mesh lath complying with ASTM C847 for requirements as follows:
 - a. Fabricate lath from zinc-coated steel sheet
 - b. Self-furring.
 - c. Weight: $\frac{3}{4}$ lb/sq. ft.
- 4. Cleavage Membrane: Asphalt felt – 15 lb., ASTM D226, Type I.
- 5. Vapor Barrier: 6-mil polyethylene sheeting.

B. Thin Setting Mortars

- 1. Use at new walls and other clean concrete surfaces (same as for floor systems.)
- 2. Manufactured graded sand aggregate and Portland cement, and acrylic/latex admixture exceeding ANSI A118.4.
- 3. Products:

- a. LATICRETE International Inc., Laticrete 272 & 3701.
 - b. MAPEI Corporation, Mapecem Premix & Planicrete AC.
 - c. MER-KRETE Systems, Mer-Krete 720 with Mer-Krete 150 Acrylic/Latex.
 - d. Or approved equal.
4. When installing new tile over the ground masonry surface of old wall tile, use a rubber based setting adhesive.
- C. Waterproofing membrane:
1. Required on shower stall walls from floor to ceiling.
 2. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber and fabric reinforcement. The product will be a trowel or roller applied thin load-bearing membrane exceeding ANSI A118.10. Membrane will accommodate minor substrate movement and provide a crack isolation membrane. Membrane will be fabric reinforced at all changes in plane.
 3. Products:
 - a. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.
 - b. MAPEI Corporation; Mapelastic L.
 - c. MER-KRETE Systems, Hydroshield 6000.
 - d. Or approved equal.
- D. Grout.
1. 100% solid epoxy grout exceeding ANSI A118.3, chemical resistant and water cleanable.
 2. Products:
 - a. MAPEI Corporation, Kerapoxy.
 - 1) Color: 19 Pearl Gray
- 2.5 ELASTOMERIC SEALANTS
- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."
 - B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

- C. For non-traffic surfaces provide One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
1. Available Products:
 - a. Dow; DOWSIL 786 Silicone Sealant - M
 - b. GE Silicones; Sanitary 1700.
 - c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - d. Tremco, Inc.; Tremsil 600 White.
- D. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout. Include primer and backer rod recommended by manufacturer.

2.6 MISCELLANEOUS MATERIALS

- A. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic base, designed specifically for flooring applications, stainless steel; ASTM A 666, 300 Series exposed-edge material.
1. Products:
 - a. Schluter Systems DILEX_AKWS.
 - b. Or approved equal.
- B. Control Joints: Aluminum legs and flanges with thermoplastic rubber movement zone.
1. Products:
 - a. Schluter Systems DILEX-AKWS.
 - b. Or approved equal.
- C. Temporary Protective Coating: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

- D. Tile Cleaner: A cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers. Emene cleaners will be used sparingly as approved by the setting bed manufacturer. These cleaners will be used as soon after installation as practical to make cleaning easier.

2.7 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile have been completed before installing tile.
 - 3. Installer shall map out all existing cracks in existing floor finishes before demolition begins so that the structural slab can be examined and investigated for the cause of such tracing in the mapped locations after demolition is complete.
 - 4. To preclude an unacceptable level of moisture in or being emitted from substrates, verify that substrate is acceptable for installation of setting bed and tile as determined by respective manufacturer's moisture testing procedure for concrete slabs or other substrates.
 - 5. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

- B. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
 - 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
 - 2. Remove protrusions, bumps, and ridges by sanding or grinding.
 - 3. On renovation projects where existing setting bed material is being removed, no soft or unbonded or otherwise unsound material will be left in place.
- C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.
- E. Protect the work and adjacent construction against damage during progress of the work until completion.

3.3 INSTALLATION, GENERAL

- A. Install wall tile first, then floor tile. Start installation of the wall tile at the lowest point of floor slopes so that the grout joint between wall tile and floor tile will be on the horizontal surface.
- B. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- C. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Unless otherwise specified, comply with TCA installation methods indicated in ceramic tile installation schedules.
- D. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- E. Avoid laying patterns of accent tiles near adjacent walls that would accent wall irregularities.
- F. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- G. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both

directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

H. Lay out tile wainscots to next full tile beyond dimensions indicated.

I. Expansion Joints: Locate expansion joints and other joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.

J. Grout tile to comply with requirements of the following tile installation standards:

1. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

3.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

B. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight. See "FLOOR TILE INSTALLATION" for installation sequence and testing procedures.

3.5 FLOOR TILE INSTALLATION

1. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

- a. Tile floors composed of tiles 8 by 8 inches or larger.

B. With the approval of the project representative that the structural slab is ready for new work, repair or prepare all cracks with the appropriate method.

C. Joint Widths: Install tile on floors with the following joint widths unless otherwise indicated:

1. Porcelain Ceramic Tile: 1/8 inch.

D. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.6 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- B. Set tile in a bond coat of latex Portland cement mortar in compliance with ANSI A108.5 and mortar manufacturer's instructions.
- C. Where wall substrate irregularities exceed ¼" in 8 feet, apply a leveling bed.
 - 1. Clean and roughen wall surfaces as require to thoroughly bond leveling bed.
 - 2. Apply mortar to required thickness and carefully screed surface to true, accurate plane. Cure under vaporproof membrane or other approved method for not less than 3 days before installing tile.
- D. In showers, install waterproofing up vertical wall surface from the floor to the ceiling and at least two feet beyond the shower edge, or as indicated on the drawings.
- E. Joint Widths: Install tile on walls with the following joint widths unless otherwise indicated:
 - 1. Porcelain Ceramic Tile: 1/8 inch.

3.7 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - 3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- C. Post suitable notices to prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Protect waterproof membrane prior to and during the installation.

- E. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.
- F. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. No other trades will work on tile floors until epoxy grout is fully cured and cleaned from the surface of the tile.

END OF SECTION

SECTION 096513 - RESILIENT WALL BASE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Resilient wall base and accessories.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.
1. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12 inches long, of each resilient product color and pattern required.
- C. Maintenance Data: For resilient products to include in maintenance manuals.
- D. Submit printed VOC statement and product data for adhesives in accordance with the General Administrative Requirements of the MSU Construction Standards 01300.1.2. Maximum VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, effective July 1, 2005 and amended January 7, 2005:
1. Cove Base Adhesives 50 g/l

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

1.5 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F in spaces to receive floor tile during the following time periods:
1. 48 hours before installation.

2. During installation.
 3. 48 hours after installation.
- B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Resilient Wall Base and Accessories: Furnish not less than 20 linear feet of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 RESILIENT WALL BASE

- A. Wall Base: ASTM F 1861.
- B. Available Manufacturers: Basis For Design – Tarkett – “Johnsonite Baseworks”
1. Color to be selected from manufacturers standard options.

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following

2. AFCO-USA, American Floor Products Company, Inc.
 3. Armstrong World Industries, Inc.
 4. Azrock Commercial Flooring, DOMCO.
 5. Burke Mercer Flooring Products.
 6. Roppe Corporation.
 7. VPI, LLC, Floor Products Division.
- C. Type (Material Requirement): TS
- D. Group (Manufacturing Method): I (solid, homogenous).
- E. Straight (toeless) for installation on carpeted flooring.
- F. Minimum Thickness: 0.125 inch.
- G. Height: 4 inches.
- H. Lengths: Coils in manufacturer's standard length.
- I. Outside Corners: Job formed.

- J. Inside Corners: Job formed.
- K. Surface: Smooth.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.
- D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - 1. Do not install resilient products until they are same temperature as space where they are to be installed.

3.3 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
 - a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 1. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 096519

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 M.S.U. ISSUES

- A. It is the intent of MSU that all resilient floor tile installation used on its projects will comply with LEED™ NC 2.2 Credit Requirements EQ Credit 4.1: Low Emitting Materials: Adhesives and Sealants
- B. It is the intent of MSU that all resilient tile flooring materials and methods of installation shall meet the latest ICC/ANSI A117.1 standards for slip resistance and provide barrier free access for mobility and physically impaired users.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Luxury vinyl tile (LVT).
 - 2. Resilient wall base and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.
 - 1. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12 inches long, of each resilient product color and pattern required.
- C. Maintenance Data: For resilient products to include in maintenance manuals.
- D. Submit printed VOC statement and product data for adhesives in accordance with the General Administrative Requirements of the MSU Construction Standards 01300.1.2. Maximum VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, effective July 1, 2005 and amended January 7, 2005:
 - 1. Cove Base Adhesives 50 g/l
 - 2. Rubber Floor Adhesives 60 g/l

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish 2 boxes of each type, color, and pattern of floor tile installed.
 - 2. Resilient Wall Base and Accessories: Furnish not less than 20 linear feet of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 LUXURY VINYL TILE

- A. Luxury Vinyl Tile (LVT): LVT-1
 - 1. Manufacturer: Amtico
 - 2. Color: Fused Birch
 - 3. Size: 184 mm x 1219.2 mm
- B. Wearing Layer: 1.0 mm
- C. Thickness: 2.5 mm

2.2 RESILIENT WALL BASE

- A. Wall Base: ASTM F 1861.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following
 - 1. AFCO-USA, American Floor Products Company, Inc.
 - 2. Armstrong World Industries, Inc.
 - 3. Azrock Commercial Flooring, DOMCO.
 - 4. Burke Mercer Flooring Products.
 - 5. Roppe Corporation.
 - 6. VPI, LLC, Floor Products Division.
 - 7. Johnsonite®
- C. Type (Material Requirement): TV (vinyl).
- D. Group (Manufacturing Method): I (solid, homogenous).
- E. Style: Cove (with top-set toe) for installation on resilient flooring. Straight (toeless) for installation on carpeted flooring.
- F. Minimum Thickness: 0.125 inch.
- G. Height: 4 inches.
- H. Lengths: Coils in manufacturer's standard length.
- I. Outside Corners: Job formed.
- J. Inside Corners: Job formed.
- K. Surface: Smooth.
- L. Color: Black

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

- C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 3. Moisture Testing:
 - a. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - 1. Do not install resilient products until they are same temperature as space where they are to be installed.
- F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis, 1/3 running bond pattern.
- B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
- C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- D. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends

occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.

2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.5 RESILIENT ACCESSORY INSTALLATION

- A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.6 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product installation:
 1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
 - a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 1. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 096800 – CARPETING

PART 1 - GENERAL

1.1 M.S.U. ISSUES

- A. When base is specified in conjunction with the carpet, it shall be square-cut straight 4-inch vinyl base, installed prior to the installation of the carpet. It shall be glued to the walls and base cabinets, with field formed corner pieces jointed at least two-feet beyond the corner. Color shall be dark brown or black consistent with the building standard.
- B. Broadloom carpet shall be installed with as few seams as possible. All seams shall be shall be seam sealed.
- C. Carpet without cushion shall be glued to the substrate. Carpet with cushion shall have cushion glued directly to the substrate. Carpet over cushion shall be installed using the double stick method.
- D. All scraps of carpet larger than ten square feet shall be delivered to the Project Representative to be stored at the building for future repairs.
- E. It is the intent of MSU that all carpet and carpet tile installation used on its projects will comply with LEED™ NC 2.2 Credit Requirements EQ Credit 4.1: Adhesives and Sealants and LEED NC 2.2 Credit Requirements EQ Credit 4.3: Low-Emitting Materials Carpets for carpets and installation accessories.

1.2 SUMMARY

- 1. Carpet Tile

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.
- B. Provide an installation diagram from the carpet installer prior to installation. It will include the following as applicable to the project:
 - 1. Columns, doorways, enclose walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 - 2. Carpet type, color, and dye lot.
 - 3. Seam locations, types, and methods.
 - 4. Type of installation.
 - 5. Pattern type, repeat size, location, direction, and starting point.

6. Pile direction.
 7. Type, color, and location of insets and borders.
 8. Type, color, and location of edge, transition, and other accessory strips.
 9. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Carpet: 12-inch- square Sample.
 2. Exposed Edge Stripping and Accessory-: 12-inch- long Samples.
 3. Carpet Seam: 6-inch Sample.
- D. Maintenance Data: Provided prior to installation of the carpeting and including the following:
1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 2. Precautions for cleaning materials and methods that could be detrimental to carpet.
- E. Submit printed VOC statement and product data for carpet and installation accessories in accordance with the General Administrative Requirements of the MSU Construction Standards 01300.1.2. Submit documentation for carpet materials of compliance with the Carpet and Rug Institute (CRI) Green Label Plus Testing Program www.carpet-rug.com/. Installation Adhesives Maximum VOC content when tested according to ASTM D 5116: 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h and also certified as compliant with CRI Green Label Plus testing program.
- 1.4 QUALITY ASSURANCE
- A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. General: Comply with CRI 104, Section 5, "Storage and Handling".
- B. All carpet shall be shipped to the site in original factory wrappings bearing labels verifying that all carpet is from the same dye lot. Carpet shall be delivered to the job site at least 48 hours prior to installation.
- 1.6 PROJECT CONDITIONS
- A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

- B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

PART 2 - PRODUCTS

2.1 CARPET TILE (CPT-1)

- 1. Manufacturer: Interface
- 2. Collection: World Woven Collection
- 3. Product: Summerhouse Brights
- 4. Color: 105493 Kiwi/Linen

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the carpet manufacturer or carpet cushion manufacturer, as appropriate.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by the carpet manufacturer or carpet cushion manufacturer, as appropriate:
- C. Seaming Cement: Product recommended by carpet manufacturer for butting cut edges at backing to form secure seams and to prevent pile loss at seams.
- D. Molding: Vinyl of appropriate width and height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the carpet manufacturer or carpet cushion manufacturer, as appropriate.
 2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the carpet manufacturer or carpet cushion manufacturer, as appropriate:
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Direct-Glue-Down Installation: Comply with CRI 104, Section 8, and "Direct Glue-Down Installation."
- B. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Do not bridge building expansion joints with carpet.
- D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 15, and "Protection of Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 M.S.U. ISSUES

- A. Painting is not required on pre-finished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
1. Pre-finished items NOT to be painted include the following factory-finished components:
 - a. Architectural woodwork and casework
 - b. Finished mechanical and electrical equipment
 - c. Light fixtures
 2. Concealed surfaces NOT to be painted include wall or ceiling surfaces in the following generally inaccessible areas:
 - a. Foundation spaces
 - b. Furred areas
 - c. Utility tunnels
 - d. Pipe spaces
 - e. Duct shafts
 - f. Mechanical rooms
 3. Operating parts NOT to be painted include moving parts of operating equipment such as the following:
 - a. Valve and damper operators
 - b. Linkages
 - c. Sensing devices
 - d. Motor and fan shafts
 4. Finished metal surfaces NOT to be painted include:
 - a. Anodized aluminum
 - b. Stainless steel
 - c. Chromium plate

- d. Copper
 - e. Bronze
 - f. Brass
 - g. Galvanized steel (unless specifically designated to be painted)
5. Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating or nomenclature plates.
- B. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and ironwork, and primed metal surfaces of mechanical and electrical equipment, in interior finished spaces only. Refer to Division 21 for additional fire protection painting requirements. Access panel covers must be painted separately, according to the following code: Electrical – orange, Communications – blue, Alarms – red.
- C. Paint exposed surfaces whether or not colors are designated in paint schedules, except where a specific designation indicates the surface or material is not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the M.S.U. project representative will select from standard colors or finishes available.

1.2 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
1. Concrete.
 2. Concrete masonry units (CMU).
 3. Steel.
 4. Wood.
 5. Gypsum board.
 6. Plaster.
- B. Surface preparation, priming and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.
- C. Related Sections include the following:
1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 2. Division 08 Sections for factory priming doors with primers specified in this Section.
 3. Division 21 Section WET-PIPE SPRINKLER SYSTEMS for fire protection painting.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, submitted to the M.S.U. Project Representative prior to project inception. List each material by the manufacturer's catalog number and general classification. The University retains the right to approve or disapprove any proposed equivalent paint products.
 - 1. Submit printed VOC statements.
 - 2. Submit printed aromatic compound statements.
 - 3. Submit printed statements demonstrating that no restricted compounds are used.
- B. Samples for initial color selection: in the form of manufacturer's color charts. After color selection, the M.S.U. project representative will furnish color chips for surfaces to be coated. It is the contractor's responsibility to provide the M.S.U. project representative with three draw downs of each product and color combination to be used for final approval.
- C. Samples for Verification, when requested: For each type of paint system and each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. An actual color sample, 4' X 4', shall be painted on one wall of the jobsite for verification of actual wall color prior to any other painting. Actual color samples of other selected paints shall be painted on appropriate surfaces for verification as directed by the M.S.U. project representative.
- E. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Federal Specification number, if applicable
 - 4. Manufacturer's stock number and date of manufacture.

5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperature continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Keep storage area neat and orderly. Remove rags and waste from storage areas daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards from handling, mixing and application.
 3. Paint/varnish removers shall be non-flammable.

1.5 PROJECT CONDITIONS

- A. Apply water based paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when temperature of surfaces to be painted and ambient air temperatures are between 45 and 95 deg F.
- C. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Benjamin Moore & Co.
1. Color **(PT-1)**: Natural Cream (OC-14)
 - a. Location: Corridor, Bedroom, Bathroom, and Lounge Ceilings
 2. Color **(PT-2)**: White
 - a. Location: Bedroom and Bathroom Ceiling/Soffits
 3. Color **(PT-3)**: Secret (AF-710)
 - a. Location: Corridor Ceiling
 4. Color **(PT-4)**: Kendall Charcoal (HC-166)
 - a. Location: Door Frames, Tackboard Trim

2.2 PAINT, GENERAL

- A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

2.3 BLOCK FILLERS

- A. High Performance Latex Block Filler: Used for filling open textured interior and exterior concrete block, above grade, before application of topcoats. This material should not be used in areas that are subject to continuous high moisture conditions such as daily washing, etc.
 1. Benjamin Moore & Co.: 206 Super Spec Masonry 100% Acrylic Hi-Build Block Filler.
- B. Severe Duty Two Component Epoxy Block Filler: Epoxy block filler used for filling open textured interior concrete block, before the application of high performance top coats. This filler should be used in all high moisture areas such as kitchens, showers, animal rooms, custodial wash areas, etc.
 1. Benjamin Moore & Co.: M31/M32 Acrylic Epoxy Block Filler
- C. METAL PRIMERS
- D. Synthetic Int., Rust-Inhibiting Acrylic Primer: Quick drying, rust-inhibiting primer for priming galvanized and ferrous and non-ferrous metal on the interior under acrylic paints and odorless alkyd semigloss or alkyd gloss enamels.
 1. Benjamin Moore & Co.: P04 Super Spec HP Acrylic Metal Primer

2.4 INTERIOR LATEX PRIMERS

- A. Interior 100% Acrylic Primer: Acrylic primer used on plaster under flat, semigloss and gloss finishes. This primer must be specifically designed for application to plaster, gypsum drywall, block and masonry surfaces and over all alkyd paints as primer for re-coat.
 1. Benjamin Moore & Co.: N023 Fresh Start Acrylic Primer

2.5 INTERIOR LATEX PAINTS

- A. Interior/Exterior Acrylic Machinery Enamel Gloss: Premium quality gloss 100% acrylic enamel for use on interior and exterior metal and concrete surfaces where abrasion is a problem. This product shall have excellent adhesion characteristics even to existing alkyd finish coats and provide a smooth brush-mark free surface. **TO BE USED ON METAL DOORS AND FRAMES.** Use deep base and ultra deep base in the same product line.
 1. Benjamin Moore & Co.: P28 DTM Gloss
- B. Interior/Exterior Acrylic Machinery Enamel Semi-Gloss: Premium quality semi-gloss 100% acrylic enamel for use on interior and exterior metal and concrete surfaces where abrasion is a

problem. This product shall have excellent adhesion characteristics even to existing alkyd finish coats and provide a smooth brush-mark free surface. TO BE USED ON METAL DOORS AND FRAMES. Use deep base and ultra deep base in the same product line.

1. Benjamin Moore & Co.: P29 Semi

C. Latex Based Interior Semi-Gloss Latex Enamel: Low odor 100% acrylic or modified styrene acrylic, (NO VINYL ACRYLIC) latex enamel for use as a semi-gloss finish over primed concrete, concrete block, wood, plaster, and gypsum drywall. This product shall have abrasion resistance at least equal to 100% of the Leneta "C" Panel when tested in accordance with ASTM D2486. Use deep base and ultra deep base in the same product line.

1. Benjamin Moore & Co.: N376 Eco Spec WB Acrylic Semi Gloss

D. Latex Based Interior Eggshell Enamel: Low odor 100% acrylic or modified styrene acrylic, (NO VINYL ACRYLIC) latex enamel for use as an eggshell finish over primed concrete, concrete block, wood, plaster, and gypsum drywall. This product shall have abrasion resistance at least equal to 75% of the Leneta "C" Panel when tested in accordance with ASTM D2486. Use deep base and ultra deep base in the same product line.

1. Benjamin Moore & Co.: N374 Eco Spec WB Acrylic Egg Shell

E. Latex Based Interior Flat Paint: Ready mixed, latex based paint for use over primed concrete, concrete block, wood, plaster, and gypsum drywall, acoustical plaster surfaces and as a "size" on cotton or canvas covering over insulation, and on all ceilings. Use deep base and ultra deep base in the same product line.

1. Benjamin Moore & Co.: N373 Eco Spec WB Acrylic Flat

2.6 INTERIOR EPOXY FINISHES

A. Acrylic Epoxy Gloss: Catalyzed acrylic epoxy gloss for use in areas of very high abrasion or where repetitive cleaning will be necessary.

1. Benjamin Moore & Co.: P43 Super Spec HP Acrylic Epoxy Gloss

B. PPG: Pitt-Glaze WB Water-Borne Acrylic Epoxy 16-551 Series Polyamide Epoxy Gloss: Catalyzed polyamide epoxy gloss for use in areas where the maximum in abrasion, moisture and chemical resistance is required.

1. Benjamin Moore & Co.: P36 Super Spec HP Acrylic Epoxy Gloss

2.7 INTERIOR WOOD FINISHING MATERIALS

A. Oil-Type Interior Wood Stain: Slow-penetrating oil-type wood stain for general use on interior wood surfaces under varnishes or was finishes.

1. PPG: Flood 1700 Wood Stain

2. O'Leary Paints: Old Masters, Finishes or Decorators Stains

3. Sherwin-Williams Company (The): Woodclassics 250 Stain A49 Series
 4. Benjamin Moore & Co.: None
 5. PPG: Deft Wood Stain
- B. Paste Wood Filler: Solvent based, air-drying, paste type wood filler for use on open grain wood on interior wood surfaces.
1. O'Leary Paints: 50001 Old Master Wood Filler
 2. Sherwin-Williams Company (The): Sher-wood Fast-Dry Filler D70T1
 3. Benjamin Moore & Co.: (236) Benwood Paste Wood Filler
- C. Interior Waterborne Urethane Satin: Clear, non-yellowing, water thinned, urethane sating, with excellent abrasion and moisture resistance. This product for use on interior stained or natural finished woodwork.
1. PPG: Wood Pride1802 Satin Urethane
 2. O'Leary Paints: A4700-270 Waterborne Urethane
 3. Sherwin-Williams Co. (The): Woodclassics Waterborne Polyurethane A-68 series V91
 4. Benjamin Moore & Co.: (N423) Stays Clear Acrylic Urethane
 5. PPG: Deft WB Poly Satin
- 2.8 SURFACE PREPARATION AGENTS: Paint and varnish removers shall be non-flammable.
- A. Oil and Grease Emulsifier: Oil and grease emulsifier for cleaning walls, ceilings floors and equipment.
1. PPG: Devoe Devprep 88
 2. O'Leary Paints: Coronado 93-500
 3. Sherwin-Williams Company (The): Extra Muscle Cleaner
 4. Benjamin Moore & Co.: P83 Oil & Grease Emulsifier
 5. PPG: Duraprep Prep88 water-based alkaline cleaner
- B. Epoxy and Urethane Remover: For stripping old epoxy or urethane coatings from surfaces to be re-coated.
1. O'Leary Paints: Star to Paste Stripper
 2. Sherwin-Williams Company (The): Savagran Super-Strip

3. PPG: Duraprep Prep220 Commercial Coating Remover
- C. Rust Removal and Metal Pre-treatment: For use in converting rust oxide and treatment of metal to promote coating adhesion.
1. O'Leary Paints: Coronado 93-300
 2. Sherwin-Williams Company (The): Macroproxy 920 Pre-Prime B58T101
 3. Benjamin Moore & Co.: None
 4. PPG: Amerlock Sealer penetrating epoxy primer sealer
- D. Concrete Etch: Concrete pre-treatment for use in removing the laitance and etching smooth concrete to improve coating adhesion.
1. O'Leary Paints: Coronado 93-400
 2. Sherwin-Williams Company (The): Startex Muriatic Acid
 3. Benjamin Moore & Co.: P85 Concrete Pre-treatment and Etch
 4. PPG: DuraPrep 100 Concrete Etch
- E. Rust Converter: For converting rust into a black protective film.
1. PPG: Devoe Preprime 167
 2. O'Leary Paints: Coronado 93-900
 3. Sherwin-Williams Company (The): Oshpo Rust Converter.
 4. Benjamin Moore & Co.: P85 Rust Converter

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.
 2. Masonry (Clay and CMU): 12 percent.
 3. Wood: 15 percent.
 4. Plaster: 12 percent.

5. Gypsum Board: 12 percent.

- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, electrical panel box doors and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing, replacing, and/or repainting, as acceptable to the M.S.U. project representative. Provide "Wet Paint" signs to protect newly painted finishes. At completion of construction activities of other trades, touch up and restore all damaged or defaced painted surfaces.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall onto wet, newly painted surfaces.
 - 2. Provide barrier coats over incompatible primers or remove and re-prime. Notify M.S.U. project representative in writing of problems anticipated with use of specified finish coat material with substrates primed by others.
- D. Cementitious Material Substrates: Remove dust, dirt, grease, oil, release agents, curing compounds, efflorescence, and chalk.
 - 1. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
 - 2. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

3. Clean concrete floors to be painted with a five percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, vacuum, rinse and allow drying before painting.
- E. Steel Substrates: Clean non-galvanized ferrous-metal surfaces that have been shop coated: remove oil, grease, dirt, loose mill scale and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush; clean with solvents recommended by the paint manufacturer, and touch-up with the same primer as the shop coat.
- F. Wood Substrates:
 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 2. Sand surfaces that will be exposed to view, and dust off.
 3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 5. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately upon delivery.
 6. Stripping and refinishing existing wood doors, trim, etc.
 - a. Contractors shall take care to achieve clean and clear surfaces that will take stain uniformly. In some instances bleaching of the wood may be necessary. All existing varnish and stripping residue shall be removed and the surface neutralized and sanded smooth to assure a smooth and uniform finish.
- G. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.
- H. Repainting: Prime coats may be omitted with the exception of patched or repaired areas that should be spot-primed to ensure a uniform finish. Special care should be taken in re-coating existing alkyd or epoxy surfaces to prevent inter-coat adhesion failures. Painting of patch and repair work shall be painted out to the nearest break line, including areas in corridors, as directed by the M.S.U. Project Representative.
- I. Paint: Carefully mix and prepare paint materials in accordance with manufacturer's directions. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials or residue. Stir material before application to produce a mixture of uniform density; stir as required during application. Remove any surface film and, if necessary, strain material before using. Do not stir surface film into material. Use only thinners approved by the paint manufacturer and only within recommended limits.
- J. Tinting: Where multiple coats of the same material are applied, tint undercoats to match the color of the finish coat, but in a sufficiently lighter shade to distinguish each separate coat.

3.3 APPLICATION

- A. Paint colors, surface treatments, and finishes are indicated in schedules. Provide finish coats that are compatible with primers used.
- B. Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been primed by others. Re-coat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- C. Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer. Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- D. Apply paints according to manufacturer's written instructions. Use applicators and techniques best suited for paint and substrate indicated. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
- E. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required in order to produce an even, smooth surface in accordance with the manufacturer's directions. Sand lightly between each succeeding enamel or varnish coat.
- F. Apply first coat to surfaces that have been cleaned, pre-treated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
- G. The term "exposed surfaces" includes areas visible when a permanent or built-in fixture, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
- H. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
- I. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
- J. All materials will be applied under adequate lighting, evenly spread and flowed on smoothly. Cut in sharp lines and color breaks.
 - 1. Pigmented (opaque) finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable.

2. Transparent (clear) finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. Concrete and Masonry (other than Concrete Masonry Units):
 1. Semi-Gloss Latex Finish:
 - a. Two coats latex semi-gloss over a primer. This system for use on surfaces that are not subject to high abrasion or continuously moist conditions.
 - 1) Prime Coat: Interior 100% Acrylic Primer
 - 2) Intermediate Coat: Latex Based Interior Semi-Gloss Latex Enamel
 - 3) Intermediate Coat: Latex Based Interior Semi-Gloss Latex Enamel
 2. Polyamide Epoxy Gloss Finish:
 - a. Two coats over epoxy sealer, total dry film thickness of the two finish coats not less than 4.0 total mils. This system to be used in all areas that are exposed to chemical attract, constant moisture or frequent washing.
 - 1) Prime Coat: Epoxy Sealer
 - 2) Intermediate Coat: Polyamide Epoxy Gloss
 - 3) Intermediate Coat: Polyamide Epoxy Gloss
- B. Concrete Masonry Units Substrates:
 1. Semi-Gloss Latex Enamel Finish:

- a. Two coats over block filler. This system for use on surfaces that are not subject to high abrasion or continuously moist conditions.
 - 1) Prime Coat: High Performance Latex Block Filler
 - 2) Intermediate Coat: Latex Based Interior Semi-Gloss Latex Enamel
 - 3) Topcoat: Latex Based Interior Semi-Gloss Latex Enamel
 2. Semi-Gloss Alkyd Enamel Finish:
 - a. Two coats over block filler with total dry film thickness not less than 3.5 mils, excluding the block filler.
 - 1) Prime Coat: High Performance Latex Block Filler
 - 2) Intermediate Coat: DTM Alkyd Semi-Gloss Enamel
 - 3) Topcoat: DTM Alkyd Semi-Gloss Enamel
 3. Polyamide Epoxy Gloss Finish:
 - a. Two coats over block filler, total dry film thickness of the two finish coats not less than 4.0 mils. This system to be used in all areas that are exposed to constant moisture or frequent washing.
 - 1) Prime Coat: Severe Duty Two Component Epoxy Block Filler
 - 2) Intermediate Coat: Polyamide Epoxy Gloss
 - 3) Topcoat: Polyamide Epoxy Gloss
- C. Ferrous (and Non-Ferrous, Galvanized, and Aluminum) Metal Substrates:
- a. Semi-Gloss Acrylic System
 - 1) Two coats over primer with total dry film thickness not less than 2.5 mils.
 - a) Prime Coat: Acrylic Zinc Metal Primer
 - b) First Coat: DTM Acrylic Semi-Gloss Enamel
 - c) Second Coat: DTM Acrylic Semi-Gloss Enamel
- D. Gypsum Drywall Systems:
1. Lusterless (Flat) Emulsion System
 - a. Two coats. Flat latex finish with good washability and excellent touch-up characteristics. This system to be used only on ceilings, or on wall surfaces that are above eight feet high.

- 1) Prime Coat: Interior 100% Acrylic Primer
 - 2) Topcoat: Latex Based Interior Flat Paint
2. Latex Interior Eggshell System
 - a. Two coats over primer
 - 1) Prime Coat: Interior 100% Acrylic Primer
 - 2) Intermediate Coat: Latex Based Interior Eggshell Enamel
 - 3) Topcoat: Latex Based Interior Eggshell Enamel
 3. Latex Interior Semi-Gloss System
 - a. Two coats over primer
 - 1) Prime Coat: Interior 100% Acrylic Primer
 - 2) Intermediate Coat: Latex Based Interior Semi-Gloss Latex Enamel
 - 3) Topcoat: Latex Based Interior Semi-Gloss Latex Enamel
 4. Odorless Acrylic Enamel Semi-Gloss System
 - a. Three coats with total dry film thickness not less than 2.5 mils.
 - 1) Prime Coat: Interior 100% Acrylic Primer
 - 2) Intermediate Coat: DTM Acrylic Semi-Gloss Enamel
 - 3) Topcoat: DTM Acrylic Semi-Gloss Enamel
 5. Polyamide Epoxy Gloss System
 - a. Two coats over Interior 100% Acrylic Primer, total dry film thickness of the two finish coats not less than 2.5 mils. This system to be used for drywall and plaster surfaces that are exposed to constant moisture or frequent washing.
 - 1) Prime Coat: Interior 100% Acrylic Primer
 - 2) Intermediate Coat: Polyamide Epoxy Gloss
 - 3) Topcoat: Polyamide Epoxy Gloss
- E. Plaster Systems:
1. Lusterless (Flat) Emulsion System

- a. Two coats. Flat latex finish with good washability and excellent touch-up characteristics. This system to be used only on ceilings, or on wall surfaces that are above eight feet high.
 - 1) Prime Coat: Interior 100% Acrylic Primer
 - 2) Finish Coat: Latex Based Interior Flat Paint
2. Latex Interior Eggshell System
 - a. Two coats over primer
 - 1) Prime Coat: Interior 100% Acrylic Primer
 - 2) Intermediate Coat: Latex Based Interior Eggshell Enamel
 - 3) Topcoat: Latex Based Interior Eggshell Enamel
3. Latex Interior Semi-Gloss System
 - a. Two coats over primer
 - 1) Prime Coat: Interior 100% Acrylic Primer
 - 2) Intermediate Coat: Latex Based Interior Semi-Gloss Latex Enamel
 - 3) Topcoat: Latex Based Interior Semi-Gloss Latex Enamel
4. Polyamide Epoxy Gloss System
 - a. Two coats over Interior 100% Acrylic Primer, total dry film thickness of the two finish coats not less than 4.0 mils. This system to be used for drywall and plaster surfaces that are exposed to constant moisture or frequent washing.
 - 1) Prime Coat: Interior 100% Acrylic Primer
 - 2) Intermediate Coat: Polyamide Epoxy Gloss
 - 3) Topcoat: Polyamide Epoxy Gloss
- F. Woodwork and Hardboard System:
- G. Stained Woodwork System:
 1. Three finish coats over stain
 - a. Stain Coat: Oil-Type Interior Wood Stain
 - b. First Coat: Interior Waterborne Urethane Satin
 - c. Second Coat: Interior Waterborne Urethane Satin

d. Third Coat: Interior Waterborne Urethane Satin

H. Problem Areas:

1. Glazed Tile, Ceramic, Porcelain, Tile, Glass, and Marble
 - a. First Coat: Acrylic Bonding Primer
 - b. Second Coat and Top Coat (required): Use appropriate systems as specified.
2. Damp Areas, Boiler Rooms, etc./ Pipes, Concrete, Walls, and Ceilings
 - a. First Coat: Acrylic Moisture Bond Primer
 - b. Second Coat: Acrylic Moisture Bond Enamel

END OF SECTION

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and field application of high-performance coating systems.

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Warranties: Provide a sample of manufacturer and applicator's warranty.

1.3 QUALITY ASSURANCE

- A. Qualifications: Provide factory trained and authorized installers with a minimum of three years experience in installing work similar to the specified work. Submit written evidence of authorization from the manufacturer that contractor is an approved applicator.
- B. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each color and type of coating required. Comply with procedures specified in PDCA P5.
 - 1. Miscellaneous Areas and Items: In area or on item selected.
 - 2. Final approval of finishes will be made from benchmark samples.
 - 3. Approved benchmark samples may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Pre-Installation Conference: Before starting the work specified herein, a pre-installation conference shall be held to discuss all aspects of the project.
- D. Manufacturer's Technical Assistance: Provide a representative to attend the pre-installation conference and review existing conditions and application procedures at project startup and periodically during the progression of the project.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1.5 PROJECT CONDITIONS

- A. Examination of Existing Conditions: Contractor shall examine existing conditions affecting this work and shall report all unsatisfactory conditions to the proper authority and will not proceed until these conditions have been corrected. Commencing work implies acceptance of existing conditions as satisfactory to the outcome of this work.
- B. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F (7 and 35 deg C).

- C. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
 - 1. Allow wet surfaces to dry thoroughly before proceeding with or continuing coating operation.
 - 2. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and temperature within the area can be maintained within limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products of the following manufacturers are listed in other Part 2 articles and use the abbreviated names shown in parentheses:
 - 1. Devoe High Performance Coatings (Devoe)
 - 2. International Coatings, Inc. (International)

2.2 MATERIALS, GENERAL

- A. Material Compatibility: For each finish indicated, provide separate component coat materials of one manufacturer 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.
- B. Material Quality: Provide manufacturer's highest grade of the various high performance coatings specified. Materials not displaying manufacturer's product identification are not acceptable.
- C. VOC Classification: Provide Low VOC high-performance coating materials, including undercoats, and finish-coat materials.
- D. Provide high performance coatings suitable for use on weathered or previously rusted steel substrates, and the following
 - 1. Exceptional corrosion protection.
 - 2. Suitable for salt and fresh water immersion.
 - 3. Low temperature cure to 0 degrees F.
- E. Cleanup Solvent: As recommended per manufacturer, T-10 Thinner.

2.3 EXTERIOR HIGH-PERFORMANCE COATINGS

- A. Recommended Film Thickness: As recommended per manufacturer, 4 to 8 mils dry and 5.9 to 11.7 mils wet.
- B. Epoxy primer / topcoat: High performance multi-purpose, surface tolerant, two – component chemically – cured epoxy semi-gloss coating.
 - 1. Bar-Rust 235; (Devoe)
 - 2. Interseal 670 HS; (International)

- C. Urethane topcoat: High performance two-component chemically cured aliphatic urethane gloss finish.
 - 1. Devthane 379 (Devoe)
 - 2. Interthane 990HS (International)
 - 3. Colors: Blended to match color selected from standard color wheel by Sherwin Williams, PPG, Glidden, or similar commercial paint.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. With Applicator present, examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.
 - 1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.
 - 2. Start of application is construed as Applicator's acceptance of surfaces within that particular area.
- B. Coordination of Work: Review other Sections in which other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible coats.

3.2 APPLICATION

- A. General: Application of coatings indicates Applicator's acceptance of surfaces and conditions.
- B. Preparation:
 - 1. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - a. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
 - 2. Cleaning: Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning.
 - 3. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
 - 4. Roughen to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
 - a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

5. Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, loose rust and other foreign substances.
 - a. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
 - b. Hand tool-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 2. Process removes all loose mill scale, loose rust, loose paint, and other detrimental foreign matter by hand chipping, scraping, sanding and wire brushing.
 - c. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 6. Nonferrous-Metal Substrates: Clean nonferrous and galvanized surfaces. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- C. Material Preparation:
1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
 2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
 3. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- D. Coating Application:
1. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
 2. Apply coatings to exposed surfaces, including areas visible when permanent or built-in fixtures, and similar components are in place, and maintain system integrity and provide desired protection.
 - a. Coat surfaces behind movable equipment same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- E. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.
1. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
 2. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.

3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.
 4. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.
- F. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.
 - a. Apply first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
 - b. Brush out and work brush coats into surfaces in an even film.
 - c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
 2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required.
 3. Spray Equipment: Use mechanical methods to apply coating if permitted by manufacturer's written instructions and governing regulations.
 - a. Use spray equipment with orifice size recommended by manufacturer for material and texture required.
 - b. Apply each coat to provide the equivalent hiding of brush-applied coats.
 - c. Do not double back with spray equipment building-up film thickness of two coats in one pass, unless recommended by manufacturer.
- G. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
- H. Prime Coats: Before applying topcoats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.
1. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a topcoat with no burn-through or other defects caused by insufficient sealing.
- I. Preparing and coating steel concealed in masonry or concrete:
1. Use Devco "Bar-Rust 235" or Interseal "670HS" for entire coating thickness.
 2. At removal of stone and masonry, bracing wall and beam shall be the responsibility of the Contractor.

3. Remove corroded steel as required. Steel shall be free from loose rust, loose paint, and other loose detrimental foreign matter.
 4. The minimum cleaning standard shall be SSPC-SP3. Clean steel to meet manufacturers minimum requirements. Do not blast clean steel.
 5. Report any loss of Section to the Architect for review and recommendations.
 6. Coat steel as required by manufacturer. Minimum dry film thickness (DFT) shall be 8 mils. Apply in two (2) coats if necessary to provide minimum DFT.
- J. Preparing and coating steel exposed to weather and ultraviolet rays:
1. Preparations and coating thickness to be similar to concealed steel in item "I" above.
 2. Provide a prime coat of Devoe "Bar-Rust 235" or International "Interseal 670HS".
 3. Provide a topcoat of Devoe "Devthane 379" or International "Interthane 990HS".
- K. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.
- L. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- M. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
 2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

END OF SECTION

SECTION 101100 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Tackable Wall Surface.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of visual display surface indicated and as follows:
 - 1. Visual Display Surface: Not less than 8-1/2 by 11 inches, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
 - 2. Trim: 6-inch- long sections of each trim profile.
- C. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.
- B. Store visual display units vertically with packing materials between each unit.

PART 2 - PRODUCTS

2.1 TACKABLE WALL SURFACE

- A. Manufacturer: Forbo.
- B. Product: Bulletin Board.
- C. Width: 1.22 metres.
- D. Height: Floor to ceiling.
- E. Seams: None – provide continuous sheet.
- F. Color: To be selected from Manufacturer's Standard.

2.2 TACKABLE WALL SURFACE ACCESSORIES

- A. Wood Trim: Fabricate 1x3 wood trim boards, routed to receive Forbo tack surface with ½” overlap. Ease edges. Trim to be continuous boards without joints or joins.
 - 1. Finish: Paint per specification INTERIOR PAINTING.
 - 2. Color: Kendall Charcoal (HC-166), **PT-4**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.
- B. Examine walls and partitions for proper backing for visual display surfaces.
- C. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.
- B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.
- C. Prepare recesses for sliding visual display units as required by type and size of unit.

3.3 INSTALLATION, GENERAL

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 CLEANING AND PROTECTION

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION

SECTION 102600 -WALL AND CORNER GUARDS

1 GENERAL

2.1 Work includes corner guards.

2 PRODUCTS

2.1 Manufacturers:

- A. Arden Architectural Specialties Inc.
- B. Construction Specialties Inc.
- C. IPC Door & Wall Protection Systems
- D. Koroseal Wall Protection Systems, Inc.
- E. Pawling Corp.
- F. Tri-Guards, Inc.
- A. Substitutions: Not Permitted - Select product from Consumers Energy Standard Finishes Document.

2.2 Product description: Solid vinyl, one piece preformed corner guard, integral color throughout full depth of material; minimum 1 inch legs, minimum 1/8 inch thickness.

2.3 Corner guard - surface mounted:

2.4 Material: High impact vinyl.

2.5 Projection from wall to outside of guard: 1/8 inch

2.6 Length: One piece.

2.7 Attachment: Self adhesive tape, double sided.

3 EXECUTION

3.1 Position corner guard 4 inches above finished floor to 48 inches above finished floor.

3.2 Schedule:

- A. Corner Guard Locations: Outside corners of stud wall construction in the following areas:
 - 1. Corridors
- B. Rooms or spaces subject to cart traffic as specified by Owner's Project Manager.

END OF SECTION

SECTION 102810 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Washroom accessories.
2. Shower room accessories.

B. Related Sections include the following:

1. Division 09 Section WATERPROOFING MEMBRANE TILING for ceramic toilet and bath accessories.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Manufacturer's warranty.

B. Samples: If requested, full size, for each accessory item to verify design, operation, and finish requirements.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.

D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

E. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.3 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.
- C. It is the intent of MSU that all toilet room accessories and their methods of installation shall meet the latest ICC/ANSI A117.1 standards to provide barrier free access and use by mobility and physically impaired users.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Brass: ASTM B 19 flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- D. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- E. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

2.2 WASHROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.
- B. Toilet Tissue (Roll) Dispenser.
 - 1. Product provided by Owner, installed by Contractor.
- C. Towel Bar:
 - 1. Manufacturer: American Specialties

2. Model No.: 7360-S18
3. Length: 18"
4. Finish: Satin

D. Robe Bar:

1. Manufacture: Safco
2. Product: 4200 Nail Head Wall Coat Rack, Two Hooks
3. Finish: Metal, Satin Aluminum

E. Grab Bar (American Specialties or approved equal)

1. Mounting: Flanges with concealed fasteners.
2. Material: Stainless steel, 0.05 inch thick with smooth, No. 4, satin finish.
3. Outside Diameter: 1-1/4 inches in women's toilet rooms, 1-1/2 inches in all other areas.
4. Model No.: 3800k Type-01

2.3 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a load in any direction of at least 250 lbf, when tested according to method in ASTM F 446.
1. Attach concealed anchors for masonry walls with toggle bolts.
 2. Bolt mounting plates to steel plate reinforcing in stud partitions, to expansion shields in concrete walls, to reinforcement in metal partitions, and to thru-bolts welded to back mounting plate, unless otherwise specified. Where back mounting plate on thru-bolts will be exposed to view, anchor the mounting plate to the wall with toggle bolts or concealed anchors.
 3. Install at 33" from the finished floor to the top of the bar.

C. Shower Accessories Mounting Heights:

1. Towel bars: 48 inches to center of bar.
2. Robe hooks: 60 inches to center of plate. In accessible shower, mount at 40" to center of plate.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 104400 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 M.S.U. ISSUES

- A. To the greatest extent possible, a cabinet shall be installed in an accessible corridor for every fire extinguisher required. Travel distance to a cabinet/extinguisher shall not exceed 75 feet, except that it shall not exceed 50 feet in areas that house flammable liquids.
- B. Fire extinguishers are supplied and installed by M.S.U. Department of Police and Public Safety. Cabinets will be sized to accommodate the following:
 - 1. One (1) 2½-gallon water pressurized fire extinguisher manufactured by Amerex Corporation (used in residence halls only).
 - 2. One (1) 5 pound carbon dioxide extinguisher manufactured by Amerex Corporation (special use only).
 - 3. One (1) 10 pound dry chemical fire extinguisher manufactured by Amerex Corporation.
- C. Fire extinguisher cabinets will be recessed unless existing conditions make semi-recessed or surface mounting necessary. Cabinets will be non-rated unless being installed in a fire rated wall.
- D. Although fire extinguishers may be wall hung in mechanical rooms, cabinets are preferred.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Owner-Furnished Material: Fire extinguishers.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
 - 1. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - 1. Sheet: ASTM B 209.
 - 2. Extruded Shapes: ASTM B 221.
- B. Stainless-Steel Sheet: ASTM A 666, Type 304.
- C. Wire Glass: ASTM C 1036, Type II, Class 1, Form 1, Quality q8, Mesh m1 (diamond), 6 mm thick.

2.2 FIRE-PROTECTION CABINET

- A. Manufacturers:
 - 1. JL Industries, Inc.
 - 2. Larsen's Manufacturing Company.
 - 3. Modern Metal Products; Div. of Technico.
 - 4. Watrous; Div. of American Specialties, Inc.
 - 5. Or approved equal.
- B. Cabinet Material: Aluminum or Stainless-steel sheet.
- C. Door Style:
 - 1. In academic buildings: wired glass panel in frame.
 - 2. In residence halls: solid metal door.
- D. Door Hardware:
 - 1. Friction or magnetic catch and a pull handle.
 - 2. Provide continuous hinge, of same material and finish as trim permitting door to open 180 degrees.

E. Accessories:

1. Identification: Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER" in raised 2" lettering, applied to cabinet door.

F. Finishes:

1. Aluminum: Clear anodic satin or dark duranodic.
2. Stainless Steel: No. 4 finish.

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate doorframes with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter doorframes.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

- B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

2.6 STAINLESS-STEEL FINISHES

- A. General: Remove tool and die marks and stretch lines or blend into finish.
- B. Bright, Directional Polish: No. 4 finish.
- C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.

END OF SECTION

SECTION 113100 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Under Counter Refrigerator
 - 2. Freestanding Microwave

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each exposed product and for each color and texture.

PART 2 - PRODUCTS

- A. Undercounter Refrigerator (typical units):
 - 1. Provide the following: GE Appliances GME04GGK/GLK
- B. Undercounter Refrigerator (Accessible units):
 - 1. Provide the following: Summit CT663BKBISHHADA
- C. Microwave:
 - 1. Provide the following: Whirlpool WMC30516h

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

END OF SECTION 11 31 00

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manually operated roller shades with single rollers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
- C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Product test reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Double Manual Roller Shades with Facia
 - 1. Draper: Dual Facia CL Flexshade
 - a. Blizzard 55% (55% openness) shade cloth – color Snowflake
 - b. Sun Bloc SB9000 (Opaque) Shade Cloth : White

2.2 MANUALLY OPERATED SHADES

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Chain-Retainer Type: Clip, jamb mount
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Roller Drive-End Location: Right side of interior face of shade

2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- E. Shadebands:
 1. Shadeband Material: Light-filtering fabric & Light-blocking fabrics providing 0%-14% Openness.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material] [Exposed with endcaps
 - b. Color and Finish: As selected by Architect from manufacturer's full range
- F. Installation Accessories:
 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
 3. Endcap Covers: To cover exposed endcaps.
 4. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
 5. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Phiffer Sheerweave 4000 w/Dow Ecolibrium 5%.
- C. Black-Out Fabric: Phiffer Sheerweave Style 7100 White

2.4 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
 1. Between (Inside) Jamb/Mullion Installation: Width equal to jamb-to-jamb or mullion to mullion dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).

PART 3 - EXECUTION

3.1 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

- B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- C. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- D. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 123530 - PREFABRICATED CASEWORK

1 GENERAL

- 1.1 Work includes cabinets and counter tops; vanity cabinets and counter tops; and casework hardware.
- 1.2 American National Standards Institute (ANSI): ANSI A156.9 - Cabinet Hardware. ANSI A161.1 - Performance and Construction Standard for Kitchen and Vanity Cabinets.
- 1.3 Kitchen Cabinet Manufacturers Association (KCMA): KCMA - Directory of Certified Cabinet Manufacturers.
- 1.4 Submit shop drawings indicating casework locations, large scale plans, elevations, rough-in and anchor placement dimensions and tolerances and clearances required.
- 1.5 Submit product data showing component dimensions and configurations.
- 1.6 Perform Work in accordance with ANSI A161.1 and KCMA certification.

2 PRODUCTS

- 2.1 Prefabricated casework manufacturers:
 - A. Basis of Design
 - A. Kraftmaid: Shaker 5 Full
 1. Maple with Shortbread Stain
 - B. Substitutions: Permitted.
- 2.2 Door and drawer fronts: Plastic laminate over particle board.
- 2.3 Bolts, nuts, washers and screws: Of size and type to suit application.
- 2.4 Concealed joint fasteners: Threaded steel.
- 2.5 Drawer and door pulls: Satin Chrome wire pull handles on 4 inch centers.
- 2.6 Catches: Magnetic.
- 2.7 Drawer slides: Extension arms, steel and ball bearing construction.
- 2.8 Hinges: Concealed.
- 2.9 Door bumpers: Resilient plastic with adhesive back; clear color; 5/16" diameter x 3/64".
- 2.10 Shelf supports: Nylon with 5 mm diameter steel pin low back; white color.
- 2.11 Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- 2.12 Fabricate corners and joints without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.

3 EXECUTION

- 3.1 Verify adequacy of support framing.
- 3.2 Install casework, components and accessories.
- 3.3 Use anchoring devices to suit conditions and substrate materials encountered.
- 3.4 Set casework items plumb and square, securely anchored to building structure.
- 3.5 Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Use filler strips; not additional overlay trim for this purpose.
- 3.6 Close ends of units, back splashes, shelves and bases.
- 3.7 Adjust doors, drawers, hardware, fixtures, and other moving or operating parts to function

- smoothly.
- 3.8 Clean casework, counters, shelves, and hardware.
 - 3.9 Do not permit finished casework to be exposed to continued construction activity.

END OF SECTION

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid surface material bathroom shelf.
 - 2. Solid surface material window stool.

1.2 ACTION SUBMITTALS

- A. Product Data: For shelf and window stool materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge profiles, and methods of joining.
- C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 SOLID SURFACE MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.
 - 1. Type: Provide Standard type unless Special Purpose type is indicated.
 - 2. Colors and Patterns:
 - a. SS-1: Corian – Designer White

2.2 FABRICATION

- A. Fabricate window stools and shelves according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Front: Straight, slightly eased at top.
 - 2. 1/2-inch- (12.7-mm-) thick, solid surface material.
- B. Joints:
 - 1. Fabricate window stools and shelves without joints.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.

- B. Sealant for window stools and shelves: Comply with applicable requirements in Section 079200 "Joint Sealants."
- C. 6x2x3 Hidden Countertop Bracket similar to manufactured products by Federal Brace for shelves.
 - 1. Color: White

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Secure window stools to subtops with adhesive according to solid surface material manufacturer's written instructions.
- B. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."
- C. Install three (3) brackets per shelf: one at each end and at the midpoint of the shelf.

END OF SECTION

SECTION 123661.19 - QUARTZ AGGLOMERATE COUNTERTOPS

1.SUMMARY

a.Section Includes:

- 1)Quartz agglomerate countertops.
- 2)Quartz agglomerate backsplashes.

2.ACTION SUBMITTALS

a.Product Data: For countertop materials.

b.Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

c.Samples: For each type of material exposed to view.

2PRODUCTS

1.QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

Product : Wilson Art Engineered Surfaces

Quartz Select

Urban Cloud Q6018

2.COUNTERTOP FABRICATION

a.Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1)Grade: Custom.

b.Configuration:

- 1)Front: [Straight slightly eased at top
- 2)Backsplash: Straight, slightly eased at corner.
- 3)End Splash: Matching backsplash

c.Joints: Fabricate countertops without joints.

3.INSTALLATION MATERIALS

- a.Adhesive: Product recommended by quartz agglomerate manufacturer.
- b.Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

3EXECUTION

1.INSTALLATION

- a.Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.
- b.Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- c.Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions.
- d.Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- e.Install backsplashes and end splashes by adhering to wall and countertops with adhesive.
- f.Install aprons to backing and countertops with adhesive.
- g.Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- h.Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.19

END OF SECTION

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

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. Piping materials and installation instructions common to most piping systems.
 - 2. Mechanical sleeve seals.
 - 3. Sleeves.
 - 4. Escutcheons.
 - 5. Grout.
 - 6. Fire-suppression equipment and piping demolition.
 - 7. Equipment installation requirements common to equipment sections.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Mechanical sleeve seals.

1.5 QUALITY ASSURANCE

- A. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression 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 fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate systems shutdown (water, fire protection, hot water heating, steam, chilled water, etc.) with MSU Project Manager/MSU Project Representative. Activation and shut down of existing systems shall be conducted by MSU personnel only.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21 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.

2.2 JOINING MATERIALS

- A. Refer to individual Division 21 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 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.

2.4 SLEEVES

- A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.5 ESCUTCHEONS

- A. Description: Plastic wall and ceiling escutcheons, with an ID to closely fit around pipe and an OD that completely covers opening.

2.6 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 FIRE-SUPPRESSION 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 fire-suppression systems, equipment, and components indicated to be removed.
 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. 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.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls and ceilings. Paint escutcheons to match the adjoining wall or ceiling.
- M. 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.
 - 6. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 7. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- O. Verify final equipment locations for roughing-in.

- P. 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 21 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. 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.
- E. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 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 fire-suppression materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.5 GROUTING

- A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

END OF SECTION 210500

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

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. Pipes, fittings, and specialties.
- 2. Fire-protection valves.
- 3. Sprinklers.

- B. Related Sections:

- 1. Division 21 Section "Fire-Suppression Standpipes" for standpipe piping.
- 2. Division 21 Section "Electric-Drive, Centrifugal Fire Pumps" for fire pumps, pressure-maintenance pumps, and fire-pump controllers.

1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig (1200 kPa) maximum.

1.4 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.
- B. Delegated Design: Design sprinkler system(s) per NFPA 13-2013, FM Global and additional design criteria on documents where indicated.
- C. Sprinkler system design shall be approved by authorities having jurisdiction.

- D. Sprinkler system shall be hydraulically designed and have a density of at least that required by the hazard rating of the area protected.

SUBMITTALS

- A. Review Procedure for Projects not involving with classrooms:
 - 1. Contractor shall submit the shop drawings, working plans including product data and hydraulic calculations where applicable, to the Factory Mutual Global (FMG) and Architect/Engineer (A/E) for their review, and to MSU Fire Marshall and IPF Planning, Design and Construction (PDC) for their record. Review shall be based on applicable NFPA Standards, current version or as specified in the construction document.
 - 2. FM Global shall provide review comments back to the A/E, MSU Fire Marshall and PDC.
 - 3. A/E shall consult with MSU PDC prior to applying comments from the FM Global, and return the shop drawings with review comments back to the Contractor. Repeat the process until the A/E approves the submittals.
 - 4. Contractor shall submit the A/E approved shop drawings to MSU Fire Marshal thru Project Representative for final approval prior to installation.
- B. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- C. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
- D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13 and FM Global that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- E. Welding certificates.
- F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- G. Field quality-control reports.
- H. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

- B. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

- 1. NFPA 13, "Installation of Sprinkler Systems."

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

- 1. Notify Owner no fewer than two days in advance of proposed interruption of sprinkler service.
 - 2. Do not proceed with interruption of sprinkler service without Owner's written permission.

1.8 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Hot dipped galvanized where indicated. Pipe ends may be factory or field formed to match joining method.

- B. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends, hot dipped galvanized where indicated.

- C. Steel Couplings: ASTM A 865, threaded, hot dipped galvanized where indicated.
- D. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- E. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
- F. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Shurjoint Piping Products.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - 2. Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe, hot dipped galvanized where indicated.
 - 3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free.
 - 1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - 2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
 - 1. Valves shall be UL listed or FM approved.
 - 2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig (1200 kPa).
 - 3. Minimum Pressure Rating for High-Pressure Piping: 250 psig (1725 kPa).
- B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. NIBCO.
 - c. Victaulic Company.
2. Standard: UL 1091 except with ball instead of disc.
3. Valves NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
4. Valves NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
5. Valves NPS 3 (DN 80): Ductile-iron body with grooved ends.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig (1200 kPa) minimum.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:
 - a. Standard-Pressure Piping Specialty Valves: 175 psig (1200 kPa) minimum.
 - b. High-Pressure Piping Specialty Valves: 250 psig (1725 kPa) minimum.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
2. Standard: UL 1726.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4 (DN 20).

6. End Connections: Threaded.

2.7 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Shurjoint Piping Products.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
2. Standard: UL 213.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGF Manufacturing Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - d. Viking Corporation.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

2.8 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Reliable Automatic Sprinkler Co., Inc.
2. Tyco Fire & Building Products LP.
3. Victaulic Company.
4. Viking Corporation.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.
3. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig (1725 kPa) minimum.
4. Temperature Rating: 165 deg. F unless otherwise indicated.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
4. Element Type: Glass bulb.
5. Characteristics:
 - a. Nominal 1/2-inch (12.7-mm) Orifice: With Discharge Coefficient K between 5.3 and 5.8.
 - b. Nominal 17/32-inch (13.5-mm) Orifice: With Discharge Coefficient K between 7.4 and 8.2.

D. Sprinkler Finishes:

1. Chrome plated.
2. Bronze.
3. Painted.

E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

F. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - d. Viking Corporation.
2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Refer to Division 21 Section "Common Work Result for Fire Suppression" for basic installation requirements.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13. Unless indicated otherwise, inspector's test connections shall be located at the end of the most remote branch line in the upper story. Test valve shall be located not over 7' above the floor and in lockable rooms. Discharge shall be to floor drain equipped with a funnel.
- H. Install sprinkler piping with drains for complete system drainage. Terminate drain lines to the nearest floor drain with funnel or to a service sink.
- I. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- J. Fill sprinkler system piping with water.

3.2 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

3.3 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. System water supply valves, isolation control valves, and other valves in feed mains shall be supervised by locking valves open. Padlocks with Best cylinders will be provided by MSU, and installed by the Contractors.
- C. Specialty Valves:
 - 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.

3.4 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

3.5 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- C. All exposed sprinkler piping in unfinished areas shall be painted red. All exposed piping in finished areas shall be painted to match the adjoining walls and ceilings. At intervals not to exceed 50 feet, provide printed identification and flow direction labels entitled "SPRINKLER-FIRE." Color shall be white letters on red background. Labels shall be snap on style equal to Seton "Setmark."

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Start and run excess-pressure pumps.
 - 6. Coordinate with fire-alarm tests. Operate as required.
 - 7. Coordinate with fire-pump tests. Operate as required.
 - 8. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.7 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

3.9 PIPING SCHEDULE

- A. Standard-pressure, wet-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one the following:
 - 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 (DN 65) and larger, shall be the following:
 - 1. Standard-weight, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 2. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.10 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
 - 1. Rooms without Ceilings: Upright sprinklers.
 - 2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as indicated.
 - 3. Wall Mounting: Sidewall sprinklers.
 - 4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
 - 5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
 - 1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - 2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 - 3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 - 4. Residential Sprinklers: Dull chrome.
 - 5. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes; with listed guard in exposed areas.

END OF SECTION 211313

SECTION 220500 - 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. Piping materials and installation instructions common to most piping systems.
2. Mechanical sleeve seals.
3. Sleeves.
4. Escutcheons.
5. Grout.
6. Plumbing demolition.
7. Equipment installation requirements common to equipment sections.
8. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 1. CPVC: Chlorinated polyvinyl chloride plastic.

2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

C. Certificate of Acceptance: Provide certificate as described in this section.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

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.

D. Permits and Inspections

1. The Plumbing Contractor shall obtain and pay for all permits required by the State of Michigan Department of Licensing and Regulatory Affairs, Plumbing Division.
2. The Plumbing Contractor shall submit, to precede request for final payment, a copy of the Certificate of Acceptance of the plumbing systems.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for 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."
- D. Coordinate systems shutdown (water, fire protection, hot water heating, steam, chilled water, etc.) with MSU Project Manager/MSU Project Representative. Activation and shut down of existing systems shall be conducted by MSU personnel only.

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. Solder Filler Metals: ASTM B 32, lead-free alloys, 95/5 tin-copper. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAgl, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. 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.
- H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
1. Manufacturers:
 - a. 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.

2.5 SLEEVES

- A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, plain ends.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: 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.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections. 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. 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.
- U. 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.
- V. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- W. Verify final equipment locations for roughing-in.
- X. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- Y. Return hot water line shall be no further than 15' from the fixture needing hot water.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

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 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section 055000 "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.

3.7 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

END OF SECTION 220500

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Bronze ball valves.
2. Cast iron ball valves.
3. Bronze lift check valves.
4. Bronze swing check valves.
5. Iron swing check valves.
6. Iron, grooved-end swing check valves.
7. Iron, center-guided check valves.

- B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction 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.
- G. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- 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.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- 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. Valve Actuator Types:
 - 1. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller.
- E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Grooved: With grooves according to AWWA C606.
 - 3. Solder Joint: With sockets according to ASME B16.18.
 - 4. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Model #77C-100 or 77C-200.
 - b. Crane Co.; Crane Valve Group; Crane Valves; Model #9302 or 9302S.
 - c. Hammond Valve; Model #8501, 8301A or 8511, 8311A.
 - d. Milwaukee Valve Company; Model #BA-400 or BA-450.
 - e. NIBCO INC; Model #T585-70 or S585-70.
 - 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: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.
- B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Conbraco Industries, Inc.; Apollo Valves.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Hammond Valve.
- d. Milwaukee Valve Company.
- e. NIBCO 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: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

2.3 CAST IRON BALL VALVES

A. Two-Piece, Full-Port, Cast Iron Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves; Model 6PLF (Lead Free)
 - b. Approved equal
2. Description:
 - a. Standard: MSS SP-72.
 - b. SWP Rating: 125 psig.
 - c. CWP Rating: 200 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Class 125 Cast Iron.
 - f. Ends: Threaded.
 - g. Seats: PTFE .
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.4 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze 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.

2. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig (1380 kPa).
- c. Body Design: Vertical flow.
- d. Body Material: ASTM B 61 or ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

B. Class 125, Lift Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Hammond Valve.
- b. Milwaukee Valve Company.
- c. NIBCO INC.
- d. Apollo Valves by Conbraco Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig (1380 kPa).
- c. Body Design: Vertical flow.
- d. Body Material: ASTM B 61 or ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: NBR, PTFE, or TFE.

2.5 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. 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. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Apollo Valves by Conbraco Industries, Inc.

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. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Apollo Valves by Conbraco Industries, 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.

2.6 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

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. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Apollo Valves by Conbraco Industries, Inc.

2. Description:

- a. Standard: MSS SP-71, Type I.
- b. CWP Rating: 200 psig (1380 kPa).
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

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; Stockham Division.
2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Composition.
 - g. Seat Ring: Bronze.
 - h. Disc Holder: Bronze.
 - i. Disc: PTFE or TFE.
 - j. Gasket: Asbestos free.

2.7 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Shurjoint Piping Products.
 - c. Tyco; Grinnell Mechanical Products.
 - d. Victaulic Company.
2. Description:
 - a. CWP Rating: 300 psig (2070 kPa).
 - b. Body Material: ASTM A 536, ductile iron.
 - c. Seal: EPDM.
 - d. Disc: Spring-operated, ductile iron or stainless steel.

2.8 IRON, CENTER-GUIDED CHECK VALVES

A. Class 125, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hammond Valve.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM A 126, gray iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.

B. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM A 126, gray iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: EPDM.

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 check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
 - 3. 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:
- 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 (DN 65) and Larger: Flanged ends.
3. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
4. For Steel Piping, NPS 2-1/2 (DN 65): Flanged ends.
5. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, bronze with brass, bronze or stainless-steel trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron ball valves, class 125.

3.6 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, bronze with bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Gate Valves: Class 125, NRS.
5. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
5. Iron, Grooved-End Swing Check Valves: 300 CWP.
6. Iron Gate Valves: Class 125, NRS.
7. Iron Globe Valves: Class 125.
8. Lubricated Plug Valves: Class 125, regular gland, flanged.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General 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. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

- B. Related Sections:

1. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
2. Division 22 Section "Vibration Controls for Plumbing Piping and Equipment" for vibration isolation devices.

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 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 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. Clevis.
 - 2. Fee and Mason.
 - 3. Anvil.
 - 4. PHD Manufacturing, Inc.

2.2 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 hot dip galvanized or cadmium plated.
- B. Stainless-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.3 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.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. PHS Industries, Inc.
 2. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa).
- C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa).
- 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 POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

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.

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. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. 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.
- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

- A. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- B. Install hangers and supports to allow controlled thermal 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.
- C. Install lateral bracing with pipe hangers and supports to prevent swaying.
- D. 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.
- E. Holes shall not be drilled or punched in beams and supporting members. Do not support piping from roof deck, other piping, ducts or equipment.
- F. Hangers and supports shall also be provided at every change of direction and within 1' of any pipe fittings and valves.
- G. Pipe hangers in fan rooms and in mechanical equipment rooms shall be provided with suitable vibration isolation units to eliminate noise transmission between the piping and the building structure.
- H. Hanger components shall not be used for purposes other than for which they were designed.
- I. Vertical runs of piping not subject to appreciable expansion shall be supported by approved wrought steel clamps or collars, securely clamped to the risers. Where required, spring supports and guides shall be provided.
- J. Where negligible movement of pipe occurs at hanger locations, rod hangers may be used for suspended lines. For piping supported from below, bases, brackets or structural cross members may be used.
- K. If the vertical angle of the hanger is greater than 4 degrees, a traveling device shall be provided for horizontal movement. For piping supported from below, rollers or roller carriages shall be used.
- L. Where significant vertical movement of the pipe occurs at the hanger location, a resilient support shall be used. Spring Cushion Hangers may be used where vertical movement does not exceed 1/4".
- M. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
- N. Riser Supports
 - 1. On a riser subject to expansion, only one support of the rigid type shall be used.
 - 2. Riser clamps shall have a positive means of engagement between the pipe and the clamp.

3. Vertical runs of piping not subject to appreciable expansion shall be supported by approved wrought steel clamps or collars, securely clamped to the risers. Where required, spring supports and guides shall be provided.
- O. Anchors, Guides and Restraints: Anchors, guides and restraints shall be provided wherever necessary to support risers, to maintain pipe in position, and to properly distribute expansion.
- P. Supplemental Framing: Supplemental framing, angles, channels or beams, shall be provided where the anchor locations do not align with the building structure or where the intended loads exceed the structural framing maximum load carrying capacity.
- Q. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- R. 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.
- S. 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 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.
- T. Plastic Pipe Hanger Installation:
1. Rigid plastic piping shall normally be supported by the same type of hangers used with steel pipe. In pressure application, hangers shall be provided with pads or cushions on the bearing surfaces.
 2. Flexible plastic tubing shall be supported continuously by metal angles or channels with special hangers.
- U. Polypropylene Pipe Hanger Installation: Support continuously between its hangers in either angle iron or sheet metal angles.
- V. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

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 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).

3.4 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 and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Use of "C" clamps and beam clamps of "C" pattern and any modifications thereof is prohibited.
- J. 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. 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).
 - 3. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 4. 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.
 - 5. 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.
 - 6. 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.
 - 7. 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.
 - 8. 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.
 - 9. 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.
- K. 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.
- L. 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. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
- M. 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. Use of "C" clamps and beam clamps of "C" pattern and any modifications thereof is prohibited.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles. Use only when it is not possible to use center loading beam clamps. Subject to prior approval by the A/E.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 6. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 7. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- N. 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.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220700 - PLUMBING 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:

- 1. Insulation Materials:
 - a. Calcium silicate.
 - b. Cellular glass.
 - c. Flexible elastomeric.
 - d. Mineral fiber.
 - e. Phenolic.
 - f. Polyolefin.
 - g. Polystyrene.
- 2. Insulating cements.
- 3. Adhesives.
- 4. Mastics.
- 5. Lagging adhesives.
- 6. Sealants.
- 7. Factory-applied jackets.
- 8. Field-applied fabric-reinforcing mesh.
- 9. Field-applied cloths.
- 10. Field-applied jackets.
- 11. Tapes.
- 12. Securements.
- 13. Corner angles.

- B. Related Sections include the following:

- 1. Division 21 Section "Fire-Suppression Systems Insulation."
- 2. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings:
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.
 - 8. Detail field application for each equipment type.
- C. 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.
- D. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Calcium Silicate:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Industrial Insulation Group (The); Thermo-12 Gold.

2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 3. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 4. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
- G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
- H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Duct Wrap.
 - d. Owens Corning; All-Service Duct Wrap.
- I. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000 Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.
 2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- J. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armacell LLC; Tubolit.
 - b. Nomaco Inc.; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.

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.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

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. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F (10 to 427 deg C).
- C. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).
- D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- F. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F (29 to plus 60 deg C).
- G. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- H. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

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.

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.

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.

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.

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: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. 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.
5. Factory-fabricated tank heads and tank side panels.
- C. Metal Jacket:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - a. Finish and thickness are indicated in field-applied jacket schedules.
 - b. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
 - c. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
 - d. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

2.10 SECUREMENTS

A. Bands:

1. 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 or closed seal.
2. 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 or closed seal.
3. 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.
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.
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.
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.
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.
6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-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.
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.

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 or 0.062-inch (1.6-mm) soft-annealed, stainless steel.

2.11 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 316.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- (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) o.c.
 - 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 self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.
- C. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe

insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 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 with 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 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

- D. Where metal jackets are indicated, install with 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) o.c. and at end joints.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- B. Tests and Inspections:

1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the

"Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 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. Vertical portions of the storm and sanitary drains.
2. Chemical waste.
3. Drainage piping located in crawl spaces.
4. Underground piping.
5. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

- C. PVC jackets shall be installed on insulated piping in conjunction with fitting covers to provide a total sealed system as required by USDA and FDA for applications in food and pharmaceutical facilities.

- D. Insulate cold pipes conveying fluids below ambient temperature with vapor retardant jackets with self sealing laps.

1. Domestic cold water.
2. Horizontal portions of the storm and sanitary drain.
3. Condensate drain.

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1/2 inch (13 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
 - c. Polyolefin: 1/2 inch (13 mm) thick.

- 2.1. NPS 1-1/4 (DN 32) and Larger All pipe sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 - c. Polyolefin: 1 inch (25 mm) thick.
- B. Domestic Hot and Recirculated Hot Water:
 1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 13/4 inch (19 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
 - c. Polyolefin: 13/4 inch (19 mm) thick.
 2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1.5 inch (25 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1.5 inch (25 mm) thick.
 - c. Polyolefin: 1.5 inch (25 mm) thick.
- C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1/2 inch (13 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
 - c. Polyolefin: 1/2 inch (13 mm) thick.
- D. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 3/4 inch (19 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
 - c. Polyolefin: 3/14 inch (19 mm) thick.
- E. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 3/41 inch (19 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
 - c. Polyolefin: 3/41 inch (19 mm) thick.
- F. Exposed or concealed sanitary drains prone to condensation:
 1. All Pipe Sizes: Insulation shall be one of the following:

- a. Flexible Elastomeric: 1/2 inch (13 mm) thick.
- b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.

3.10 OUTDOOR AND TUNNEL PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. All pipe sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1.5 inch (25 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1.5 inch (25 mm) thick.
 - c. Polyolefin: 1.5 inch (25 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1.5 inch (19 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1.5 inch (13 mm) thick.
 - c. Polyolefin: 1.5 inch (19 mm) thick.
2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 2 inch (25 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inch (25 mm) thick.
 - c. Polyolefin: 2 inch (25 mm) thick.

3.103.11 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. Equipment, Concealed:
 1. None.
- C. Equipment, Exposed:
 1. None.
- D. Piping, Concealed:
 1. None.
- E. Piping exposed in mechanical equipment rooms or in finished spaces below 10' above finished floor:

1. PVC: 20 mils (0.5 mm) thick.
2. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
- 2. Encasement for piping.

- B. Related Section:

- 1. Division 22 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Construction Representative no fewer than seven days in advance of proposed interruption of water service.
 - 2. Do not proceed with interruption of water service without Construction Representative's written permission.

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."
- C. Piping materials shall bear label, stamp, or other markings of specified testing agency.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) water tube, annealed temper.
- C. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Appurtenances for Grooved-End Copper Tubing:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 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:
 - a. Copper-tube dimensions and design similar to AWWA C606.
 - b. Ferrous housing sections.
 - c. EPDM-rubber gaskets suitable for hot and cold water.
 - d. Bolts and nuts.
 - e. Minimum Pressure Rating: 300 psig (2070 kPa).

2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe:
 - 1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

- B. Standard-Pattern, Mechanical-Joint Fittings:
 - 1. AWWA C110/A21.10, ductile or gray iron.
 - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Compact-Pattern, Mechanical-Joint Fittings:
 - 1. AWWA C153/A21.53, ductile iron.
 - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- D. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.
- E. Appurtenances for Grooved-End, Ductile-Iron Pipe:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Victaulic Company.
 - 2. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions that match pipe.
 - 3. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:
 - a. AWWA C606 for ductile-iron-pipe dimensions.
 - b. Ferrous housing sections.
 - c. EPDM-rubber gaskets suitable for hot and cold water.
 - d. Bolts and nuts.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

- A. Galvanized-Steel Pipe:
 - 1. ASTM A 53/A 53M, Type E, Grade B, Standard Weight.
 - 2. Include ends matching joining method.
- B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.
- C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- D. Malleable-Iron Unions:
 - 1. ASME B16.39, Class 150.
 - 2. Hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal, bronze seating surface

4. Threaded ends.
- E. Flanges: ASME B16.1, Class 125, cast iron.
- F. Appurtenances for Grooved-End, Galvanized-Steel Pipe:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Victaulic Company.
 2. Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A 47/A 47M, malleable-iron casting; ASTM A 106/A 106M, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 3. Fittings for Grooved-End, Galvanized-Steel Pipe:
 - a. AWWA C606 for steel-pipe dimensions.
 - b. Ferrous housing sections.
 - c. EPDM-rubber gaskets suitable for hot and cold water.
 - d. Bolts and nuts.
 - G. Zinc used in galvanizing shall meet the requirements of ASTM B-6 and shall be applied using 2 ounces of zinc per square foot of coated surface.
 - H. Reducing couplings, snap-joint couplings, and Vic-boltless couplings are not acceptable.
 - I. Hole cut piping, pressfit, and plain end piping systems will not be accepted.
 - J. Gasket material for water service up to 200 degree F shall be EPDM rubber, grade E.

2.5 STAINLESS-STEEL PIPE AND FITTINGS

- A. Stainless-Steel Pipe: Schedule 10S, ASTM A 312/A 312M, Type 304/304L, seamless or electric resistance welded pipe.
- B. Grooved-Joint Systems:
 1. Manufacturers:
 - a. Victaulic Company; Style 489.
 2. Grooved-End, Stainless Steel-Piping Fittings: Schedule 10S, Type 304L or 316L stainless steel from material conforming to ASTM A 403 or pipe conforming to ASTM A 312, or sheet conforming to ASTM A 240; with dimensions matching stainless steel pipe.
 3. Grooved-End, Stainless Steel-Piping Couplings: ASTM A 743, cast Type 316L stainless steel, EPDM gaskets, and stainless steel bolts and nuts.
 - a. Rigid Type: To provide rigidity and system support and hanging in accordance

with ANSI B31.1 and B31.9.

- C. Flanges: ASME B16.1, Classes 125 and 250, constructed of ASTM A 351, Type 304L stainless steel.

2.6 PIPING JOINING MATERIALS

- A. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.7 ENCASUREMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105/A21.5.
- B. Form: Sheet.
- C. Color: Black or natural.

2.8 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.

2.9 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.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic installation requirements.
- B. 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.
- C. Install eccentric reducing couplings, flush on the top for water lines, where air or water pockets would otherwise occur due to a reduction in pipe size.
- D. Cap and plug all openings in pipes with suitable metal plugs or cap to keep out dirt and rubbish during construction until equipment is connected.
- E. Install domestic water piping level without pitch and plumb.
- F. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- G. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

- H. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- I. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- J. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball for piping NPS 6 and smaller.
- K. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
- L. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.2 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.
- D. 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.
- E. 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.
- F. 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.
- G. 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.

- H. 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.
- I. Flanged Joints: Select appropriate asbestos-free gasket material, size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- J. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D 2855.
- K. 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.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - 1. NPS 2 (DN 50) and Smaller: Use dielectric couplings or nipples.
 - 2. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric nipples.
 - 3. NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, riser 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.

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 hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
 5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
 6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
 7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
 8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.
- G. Install supports for vertical steel piping every 15 feet (4.5 m).
- H. Install hangers for cast iron piping with the following horizontal spacing:
1. 10 feet maximum.
 2. Minimum of one hanger per pipe section close to joint on the barrel. Also at change of direction and branch connections.
- I. Install hangers for ductile iron piping with the following horizontal spacing:
1. 10 feet maximum.
 2. Minimum of one hanger per pipe section close to the joint behind the bell and at change of direction and branch connections.

- J. 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. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Pipe sizes indicated shall be carried full size to equipment served. Any change of size to match equipment connection shall be made within one foot of the equipment. At temperature control valves with sizes smaller than connected lines, reduction shall be made immediately adjacent to valves.
- D. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- E. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.

3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. 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 standing for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

- A. All piping shall be cleaned before the installation, and flushed after the installation and before system startup.
- B. Equipment, detergents, solvents and other cleaning agents shall be furnished by a qualified water treatment services.
- C. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush 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.
- D. 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.
- E. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- F. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 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: Brazed joints may be used on aboveground copper tubing. Extruded-tee connections are prohibited.
- D. In-building-slab, domestic water, trap seal primer piping, NPS 1 (DN 25) and smaller, shall be the following:
 - 1. PEX tube, fittings for PEX tube, and crimped joints.
- D.E. Under-building-slab, domestic water, building service piping, NPS 2 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); copper pressure-seal fittings; and pressure-sealed joints.
- E.F. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought- copper solder-joint fittings; and soldered joints.
- F.G. Aboveground domestic water piping, NPS 2-1/2 and larger, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); grooved-joint copper-tube appurtenances; and grooved joints.
 - 2. Stainless-Steel Pipe: Schedule 10S, ASTM A 312/A 312M, Type 304/304L; grooved-joint stainless steel appurtenances; and grooved joints.
- G.H. Aboveground, combined domestic-water-service and fire-service-main piping, NPS 5 (DN 125) and larger, shall be the following:
 - 1. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

3.12 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball valves for piping NPS 6 and smaller. Use butterfly valves with flanged ends for piping NPS 8 and larger.
 - 2. Drain Duty: Hose-end drain valves.

- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Water pressure-reducing valves.
 - 3. Balancing valves.
 - 4. Strainers.
 - 5. Hose bibbs.
 - 6. Water hammer arresters.
 - 7. Air vents.
 - 8. Flexible connectors
- B. Related Sections include the following:
 - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 2. Division 22 Section "Domestic Water Piping" for water meters.
 - 3. Division 22 Section "Domestic Water Filtration Equipment" for water filters in domestic water piping.
 - 4. Division 22 Section "Emergency Plumbing Fixtures" for water tempering equipment.
 - 5. Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 INFORMATION SUBMITTALS

- A. Field quality-control test reports.

1.6 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Ames Co.
- b. Apollo Valves by Conbraco Industries, Inc.
- c. Conbraco Industries, Inc.
- d. FEBCO; SPX Valves & Controls.
- e. Sioux Chief.
- f. Watts Industries, Inc.; Water Products Div.
- g. Woodford Manufacturing Company.
- h. Zurn Plumbing Products Group; Wilkins Div.

- B. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

- 1. Standard: ASSE 1001.
- 2. Body: Bronze.
- 3. Inlet and Outlet Connections: Threaded.
- 4. Finish: Rough bronze.

- C. Hose-Connection Vacuum Breakers:

- 1. Standard: ASSE 1011

2. Body: Brass, nonremovable, with automatic drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Rough bronze.

D. Pressure Vacuum Breakers:

1. Standard: ASSE 1020.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
4. Accessories: Ball valves, on inlet and outlet.

2.4 WATER PRESSURE-REDUCING VALVES

A. Water Regulators

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.5 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. ITT Industries; Bell & Gossett Div.
 - c. Taco, Inc.
2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Body: Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. ITT Industries; Bell & Gossett Div.
 - c. Taco, Inc.
2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2.
4. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size: 0.094 inch.
6. Drain: Pipe plug.

2.7 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows or copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.8 AIR VENTS

A. Manual Air Vents:

1. Manufacturers:
 - a. Bell & Gossett; No. 4V
2. Type: Loosed key screwdriver stop.
3. Pressure Rating: 150 psi minimum pressure rating at 250 degree F.
4. Material: Stainless steel.
5. Connections: ½" FPT / ¾" MPT.

B. Automatic Air Vents:

1. Manufacturers:
 - a. Bell & Gossett; No. 4V
2. Material: Brass body with non-ferrous internals.
3. Pressure Rating: 150 psi minimum pressure rating at 240 degree F.
4. Connections: ½" FPT / ¾" MPT.

2.9 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

2.10 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Flex-Hose Co., Inc.
 2. Metraflex, Inc.
- B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 1. Working-Pressure Rating: Minimum 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 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. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. 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. Install in an accessible location to facilitate testing and servicing with the height between 12" and 60" above the floor or grade unless instructed otherwise by applicable code.
 2. Locate backflow preventers in same room as connected equipment or system.
 3. Install backflow preventers with an air gap drain cup provided by same manufacturer, located under the pressure differential section, and piped full size of the air gap to the nearest floor drain.
 4. Do not install bypass piping around backflow preventers.
- C. Install vacuum breakers on all outlets where hoses can be attached, such as laboratory faucets, service sinks, wall hydrant, etc.
- D. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 1. Install thermometers and water regulators if specified.
 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- E. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- F. Install water hammer arresters in water piping according to PDI-WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors/panels.
- G. Install air vents at high points of water piping.
- H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- I. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

- J. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.
- K. Install trap primers in accessible locations. Do not install trap primers in ceilings.
- L. Install temperature and pressure relief valves in the shell of each domestic hot water generators, and as indicated on the drawings. Pipe the discharge connection from each valve to the drainage system through an open drain.
- M. Install integral spring check on all two-handle faucets where hoses can be attached.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

3.3 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B. Install bronze-hose flexible connectors in copper domestic water tubing.
- C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.4 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. Reduced-pressure-principle backflow preventers.
 - 3. Carbonated-beverage-machine backflow preventers.
 - 4. Reduced-pressure-detector, fire-protection backflow-preventer assemblies.
 - 5. Water pressure-reducing valves.
 - 6. Calibrated balancing valves.
 - 7. Primary, thermostatic, water mixing valves.
 - 8. Supply-type, trap-seal primer valves.
 - 9. Trap-seal primer systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each pressure vacuum breaker and reduced-pressure-principle backflow preventer 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.

3.6 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

SECTION 221316 - 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. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.
- B. Related Sections include the following:
 - 1. Division 22 Section "Sanitary Sewerage Pumps."
 - 2. Division 22 Section "Facility Sanitary Sewers."
 - 3. Division 22 Section "Chemical Waste-Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.

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 ACTION SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. LEED Submittal:

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 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.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
 - 2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Comply with requirements in "Piping Applications" Article for applications of pipe, tube, fitting, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Heavy-Duty, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - a. ANACO-Husky; Series 4000.
 - b. Clamp-All Corp.
 - 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

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
- C. Adhesive Primer: ASTM F 656.
- 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).

2.5 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.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

- F. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
- G. 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."
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of cast iron increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.2 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.

2. 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.
 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 horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 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 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
 5. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
- F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
- G. 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 5 (DN 100 and 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 5. NPS 8 to NPS 12 (DN 200 to 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.

3.4 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 horizontal backwater valves with cleanout cover flush with floor.
 - 5. Comply with requirements for backwater valves cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 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.

3.5 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.6 FIELD QUALITY CONTROL

- A. Drainage system shall be inspected and tested in accordance with State of Michigan Plumbing Code.
- B. 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.
- C. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

- E. 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 (30 kPa) head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (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.

3.7 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.

3.8 PIPING SCHEDULE

- A. Aboveground, soil and waste piping shall be any of the following:
1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- B. Aboveground, vent piping shall be any of the following:
1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- C. Underground, soil, waste, and vent piping shall be of the following:
1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Backwater valves.
 - 2. Cleanouts.
 - 3. Floor drains.
 - 4. Trap Seal Protection Devices
 - 5. Miscellaneous sanitary drainage piping specialties.
 - 6. Grease Interceptors
- B. Related Sections include the following:
 - 1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

- B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Cast-Iron Floor Cleanouts:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
- 3. Size: Same as connected branch.
- 4. Type: Heavy-duty, adjustable housing.
- 5. Body or Ferrule: Cast iron.
- 6. Outlet Connection: Spigot.
- 7. Closure: Brass plug with straight threads and gasket.
- 8. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
- 9. Frame and Cover Shape: Round.
- 10. Top Loading Classification: Heavy Duty.
- 11. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

B. Cast-Iron Wall Cleanouts:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.36.2M. Include wall access.
- 3. Size: Same as connected drainage piping.
- 4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
- 5. Closure: Raised-head, brass plug.
- 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- 7. Wall Access: Round, stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

A. General Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Cast iron.
5. Seepage Flange: Required.
6. Clamping Device: Required.
7. Outlet: Bottom.
8. Top or Strainer Material: Nickel bronze.
9. Top of Body and Strainer Finish: Nickel bronze.
10. Top Shape: Round.
11. Dimensions of Top or Strainer: 6"
12. Top Loading Classification: Light Duty.
13. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet.
14. Trap Seal Protection: Barrier type.

B. Shower/Toilet Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Cast iron.
5. Seepage Flange: Required.
6. Clamping Device: Required.
7. Outlet: Bottom.
8. Top or Strainer Material: Nickel bronze.
9. Top of Body and Strainer Finish: Nickel bronze.
10. Top Shape: Round.
11. Dimensions of Top or Strainer: 7"

12. Top Loading Classification: Light Duty.
13. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet.
14. Trap Seal Protection: Barrier type.

2.3 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Durgo, Inc.
 - b. Oatey.
 - c. ProSet Systems Inc.
 - d. RectorSeal.
 - e. Studor, Inc.
2. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected fixture or branch vent piping.

B. Stack Air-Admittance Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Durgo, Inc.
 - b. Oatey.
 - c. Studor, Inc.
2. Standard: ASSE 1050 for vent stacks.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected stack vent or vent stack.

2.4 TRAP SEAL PROTECTION DEVICES

A. Barrier Type Trap Seal Protection Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. SureSeal Manufacturing; Inline Floor Drain Trap Sealer.
2. Standard: ASSE 1072-2007.
3. Body: ASB Plastic
4. Diaphragm & Sealing Gasket: Neoprene Rubber
5. Size: 2 inch (50 mm), 3 inch (75 mm), 3-1/2 inch (89 mm), or 4 inch (100 mm).
6. Gravity Drain Outlet Connection: Compression fit sealing gasket 80 durometer.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch minimum water seal.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
 5. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor. In no cases shall access be from below, through the ceiling space.
 6. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall. Cleanout plug shall not be recessed more than 1 inch from the cover plate at the finished wall.
 7. Cleanouts for water closets shall be brought up to above flood rim of the fixtures.

- D. Plumbing fixtures are not to be used in place of cleanouts for the removal of obstruction.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
 - 5. Install trap-seal protection devices in floor drains during trim out stage of project.
- F. All floor drains shall be flashed with six pound sheet lead, 24 inches square, fitted to the clamping rings on the drains, and with outside edges of flashing worked into the floor construction to effect a watertight installation.
- G. All floor drains and cleanouts which occur in the ground floors which are waterproofed shall be flashed.
- H. Install fixture air-admittance valves on fixture drain piping.
- I. Install stack air-admittance valves at top of stack vent and vent stack piping.
- J. Install air-admittance-valve wall boxes recessed in wall.
- K. Install deep-seal traps on floor drains and other waste outlets.
- L. Install floor-drain, barrier type trap seal protection device on inlet to floor drains that require trap-seal protection.
 - 1. Size: Same as floor drain inlet.
- M. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system. Indirect waste receptors shall not be installed above ceilings or in any inaccessible, concealed or unventilated area.
- N. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- P. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

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. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Water closets.
7. Lavatories.
8. Showers.

- B. Related Sections include the following:

1. Division 22 Section "Emergency Plumbing Fixtures."
2. Division 22 Section "Drinking Fountains and Water Coolers."

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 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in emergency, operation, and maintenance manuals.

1.6 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. The earthenware of all fixtures must be unmarked, true and level. Vitreous ware shall be warranted not to craze, discolor or scale.

- B. All faucets and exposed traps, fittings, trim, connections, etc., for fixtures, shall be of polished chromium plated brass unless specified otherwise.

2.2 LAVATORY FAUCETS

A. Lavatory Faucets (single lever manual faucet)

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Chicago Faucets 420-T41ABCP
 - b. Symmons
- 2. Description: ADA Compliance. Single Lever mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Chrome plate.
 - c. Maximum Flow Rate: 0.5 gpm.
 - d. Centers: 4 inches.
 - e. Mounting: Deck, exposed.
 - f. Valve Handle(s): Lever, 4 inches.
 - g. Inlet(s): NPS 1/2 male shank.
 - h. Spout: Rigid type.
 - i. Spout Outlet: Aerator.
 - j. Operation: Non-compression, manual.
 - k. Drain: Grid.
 - l. Tempering Device: Thermostatic ceramic

B. Lavatory Faucets (dual handle manual type)

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Chicago Faucets.
 - b. T & S Brass and Bronze Works, Inc; Model B-0871-CR-LF05.
- 2. Description: ADA Compliance. Two-handle mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Chrome plate.
 - c. Maximum Flow Rate: 0.5 gpm.
 - d. Centers: 4 inches.
 - e. Mounting: Deck, exposed.
 - f. Valve Handle(s): Lever, 4 inches.

- g. Inlet(s): NPS 1/2 male shank.
- h. Spout: Rigid type.
- i. Spout Outlet: Aerator.
- j. Operation: Non-compression, manual.
- k. Drain: Grid.
- l. Tempering Device: Thermostatic if required.

2.3 SHOWER FAUCETS

A. Individual Shower Faucets,:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Delta 52102-MB
 - b. Delta 75800-140
 - c. Symmons
- 2. Description: ADA Compliance. Single-handle pressure-balance valve. Include hot- and cold-water indicators; check stops; and shower head, arm, and flange. Coordinate faucet inlets with supplies and outlet with diverter valve.
 - a. Body Material: Solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 2.5 gpm, unless otherwise indicated.
 - d. Diverter Valve: Integral with mixing valve.
 - e. Mounting: Exposed.
 - f. Backflow Protection Device for Hand-Held Shower: Not required.
 - g. Operation: Noncompression, manual.
 - h. Antiscald Device: Integral with mixing valve.
 - i. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
 - j. Supply Connections: NPS 1/2.
 - k. Shower Head Type: Ball joint. Manufacturer: Delta
 - l. Shower Head Material: Metallic with chrome-plated finish.
 - m. Spray Pattern: Adjustable.
 - n. Integral Volume Control: Required.
 - o. Shower-Arm Flow-Control Fitting: Not required.
 - p. Temperature Indicator: Not required.
 - q. Accessories: Soap dish, sloped metal top cap and stainless steel covering.

B. Group Shower Faucets:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bradley; Type CA.

2. Description: Six foot high stainless steel column shower with shower heads containing separate volume controller set at 3 gpm, supplies and drain from below. Provide necessary soap trays, cover for column top, and stop valves.
 - a. Valves: Slide-by washer-less type with colored indicating buttons red for hot and blue for cold. Hot water valve to be on the bottom.

2.4 FLUSHOMETER

A. Water Closet Flushometers (hands free applications)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Sloan Valve Company; Model Royal 111-1.6 SFSM-TMO (3910275)
 - b. Sloan Valve Company; Model EBV500A – Retro-Fit to convert existing manual valves to sensor valves (3325500)
2. Description: Exposed water-closet flushometer for wall hung top spud bowls. Single flush side mount sensor operator with -TMO (True Mechanical Override). Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
 - a. Internal Design: Diaphragm operation.
 - b. Style: Exposed.
 - c. Inlet Size: NPS 1.
 - d. Trip Mechanism: Oscillating, lever-handle actuator. ADA Compliance.
 - e. Consumption: 1.6 gal./flush.
 - f. Tailpiece Size: NPS 1-1/2 and standard length to top of bowl.
 - g. Power: Hardwired power converter.

B. Water Closet Flushometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Sloan Valve Company; Model Royal 111-1.6 (3010000)
2. Description: Exposed water-closet flushometer for wall hung top spud bowls. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.

- a. Internal Design: Diaphragm operation.
- b. Style: Exposed.
- c. Inlet Size: NPS 1.
- d. Trip Mechanism: Oscillating, lever-handle actuator. ADA Compliance.
- e. Consumption: 1.6 gal./flush.
- f. Tailpiece Size: NPS 1-1/2 and standard length to top of bowl.

2.5 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bemis/Church Seats; Model 2155SSC.
 - b. ProFlo; Model PFTSCOFA2000WH.
 - c. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Description: Toilet seat for water-closet-type fixture.
 - a. Material: Molded, solid plastic with antimicrobial agent.
 - b. Configuration: Open front without cover.
 - c. Size: Elongated.
 - d. Hinge Type: SS, self-sustaining.
 - e. Class: Heavy-duty commercial.
 - f. Color: White.

2.6 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.

2.7 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.

2.8 WATER CLOSETS

A. Water Closets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Sloan Valve Company ST2459-STG (with Sloan Tec Glaze) Preferred (2172459)
 - b. American Standard Companies, Inc.; Model "Afwall" 2257.103.
 - c. Kohler Co.; Model "Kingston" K-4325.
 - d. Zurn Industries, LLC; Commercial Brass and Fixtures.
 - e. Sloan Royal
2. Description: ADA compliance, wall-mounting, vitreous-china fixture designed for flushometer valve operation.
3. Style: Flushometer valve.
 - a. Bowl Type: Elongated with siphon-jet design with 1 ½" top spud. Include chromium plated mounting nuts and washers, and vandal-proof trim.
 - b. Height: Standard or accessible as shown.
 - c. Design Consumption: 1.6 gal./flush.
 - d. Color: White.
4. Flushometer: As specified
5. Toiler Seat: As specified
6. Fixture Support: As specified.
7. Gasket: Sexauer No. 060855, 5" x 1". Wax rings not allowed on wall-hung water closets.

2.9 LAVATORIES

A. Lavatories:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Standard Companies, Inc.; Model "Lucerne" 0355.012.
 - b. Kohler Co.; "Greenwich" K-2032.
 - c. Sloan Valve Company.
 - d. Zurn Commercial Plumbing Fixtures.
 - e. Symmons
 - f. Chicago
2. Description: ADA Compliance, wall-mounting, vitreous-china fixture.
- a. Type: With back.
 - b. Size: 20 by 18 inches rectangular.
 - c. Faucet Hole Punching: Three holes, 4-inch centers.
 - d. Faucet Hole Location: Top.
 - e. Pedestal: Not required.
 - f. Color: White.
 - g. Faucet: As specified.
 - h. Supplies: NPS 3/8 chrome-plated copper with stops.
 - i. Drain: Grid.
 - j. Drain Piping: NPS 1-1/4 chrome-plated, P-trap; NPS 1-1/4, 17 gauge thick tubular brass waste to wall; and wall escutcheon.
 - k. Hair Interceptor: Not required
 - l. Protective Shielding Guard(s): Supplies as required.
 - m. Fixture Support: As specified.

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 flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- L. Install toilet seats on water closets.
- M. Install trap-seal liquid in dry urinals.
- N. 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.
- O. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- P. 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.
- Q. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- R. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

- S. 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."
- T. 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."
- U. 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.
- V. Caulk all restroom fixtures wall and floor-mounted with latex caulk. Do not use silicone.
- W. Lavatories: Mount at 34" above the finished floor.
- X. Water Closets: Mount at 15 inches above finished floor, except at 17 inches above the finished floor for accessible fixtures.
- Y. When installing a custodial closet sink or a floor-mounted service sink with a wall-mounted faucet, the surface from both side edges up to the faucet including the faucet mounting shall be covered with a non-permeable splash guard.

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: Brasscraft KT series ¼ turn ball stop, 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 224000

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. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. HVAC demolition.
8. Equipment installation requirements common to equipment sections.
9. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
 1. EPDM: Ethylene-propylene-diene terpolymer rubber.

2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

- C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate systems shutdown (water, fire protection, hot water heating, steam, chilled water, etc.) with MSU Project Manager/MSU Project Representative. Activation and shut down of existing systems shall be conducted by MSU personnel only.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, 95/5 lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAgl, silver alloy for refrigerant piping, unless otherwise indicated.

- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

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 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. 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, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- D. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.
- 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 (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

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. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. 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.
- F. 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.
- G. Provide swing joints and expansion bends wherever required to allow the piping to expand without undue stress to connections or equipment.
- H. Exposed piping around fixtures or in other conspicuous places shall not show tool marks at fittings.
- I. Isolate pipe from the building construction to prevent transmission of vibration to the structure and to eliminate noise.
- J. Install piping such that any equipment connected to piping may be removed by disconnecting two (2) flanges or unions and removing only one or two pipe sections. All equipment shall have bolted or screwed flanges or unions at pipe connections.
- K. 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.
- L. 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.

- M. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- N. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- O. Install piping to permit valve servicing.
- P. Install piping at indicated slopes.
- Q. Install piping free of sags and bends.
- R. Install piping to allow application of insulation.
- S. Eccentric reducing couplings shall be provided in all cases where air or water pockets would otherwise occur due to a reduction in pipe size.
- T. Cap and plug all openings in pipes during construction with suitable metal plugs or cap to keep out dirt and rubbish until equipment is connected.
- U. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- V. Select system components with pressure rating equal to or greater than system operating pressure.
- W. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - b. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
 - c. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
 - d. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
 - e. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - 2. Existing Piping: Use the following:
 - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.

- d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - e. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
 - f. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- X. 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 below grade perimeter walls or slabs on grade shall have the space between the pipe and sleeve sealed watertight.
 - 5. 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.
 - 6. 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.
 - 7. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Y. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Z. Verify final equipment locations for roughing-in.
- AA. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

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. Install dielectric 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. Pipe sizes indicated shall be carried full size to equipment served. Any change of size to match equipment connection shall be made within one foot of the equipment. At temperature control valves with sizes smaller than connected lines, reduction shall be made immediately adjacent to valves.
- D. No Uni-flange pipe adapters will be allowed.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B.A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C.B. Field Welding: Comply with AWS D1.1.

3.7 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 230500

SECTION 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. This Section specifies the motors for HVAC equipment for buildings and structures.
2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein for a complete operating system.
3. Applicable sections of Division 26 - Electrical

1.3 SUBMITTALS

- A. Shop Drawings

1. Motors

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70, “National Electrical Code”

PART 2 - PRODUCTS

2.1 Motors

- A. Motors 1/3 HP and smaller shall be 120 volts, single phase. Motors 1/2 HP and larger shall be 208, 230, or 460 volts, 3 phase. Motors shall be size and rating as indicated on the drawing. Motors that are an integral part of special equipment may vary from above to meet manufacturing standards.

- B. Motors shall be NEMA Design B, Class B, 1.15 S.F. at 40 deg. C ambient or 1.00 S.F. at 65 deg. C ambient.
- C. Motors shall be grounded with manufacturer's supplied grounding kit.
- D. All motors shall be ball bearing type. Ball bearings shall be sealed on both sides, manufactured be Fafnir, FAG, or SKF.
- E. Motors served by variable frequency drives shall have an AEGIS SGR bearing protection ring.
- F. Motor enclosure shall be suitable for the service conditions.
- G. Motors shall be Super-E manufactured by Baldor, EQP manufactured by Toshiba, or approved equal.

PART 3 - EXECUTION

Not Used

END OF SECTION 220513

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Equipment supports.

- B. Related Sections:

- 1. Division 23 Section "Vibration Controls for HVAC Piping and Equipment" for vibration isolation devices.
 - 2. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Provide all necessary hangers, rods, supports, concrete inserts, etc., and proper size angles, channels, or unistruts to support all piping in a manner allowing movement during expansion and contraction. These supporting structures shall not be overstressed. All piping shall be supported with approved hangers designed for vertical adjustment and capable of carrying normal loads in all conditions of operation.

1.5 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.2 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

PART 3 - EXECUTION

3.1 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.

3.2 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Use only circular cross-section rod hangers to connect to building structural attachments to pipe support devices. Rod couplings are not acceptable.
- C. Use of "C" clamps and beam clamps of "C" pattern and any modifications thereof is prohibited.
- D. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

- E. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- F. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- G. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- H. 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. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 4. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 - 5. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 - 6. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- I. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

END OF SECTION 230529

SECTION 230800 - COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.
- B. Related Sections:
 - 1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.
- C. Owner will engage the Commissioning Authority under separate contract.

1.3 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. AExA: Commissioning representative of the Architect/Engineer.
- C. CxA: Commissioning Authority.
- D. CxM: Commissioning Manager. The commissioning representative of the CM, appointed by the CM to manage and lead the commissioning effort on behalf of the CM.
- E. CxR: Commissioning Representatives. Members of the Construction Manager's (CM) staff, contractor's, sub-contractors', manufacturers' and suppliers' staff, Owner's staff, Architect/Engineer's staff, or Owner's independent contractor assigned to participate in the commissioning process.
- F. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.
- G. TAB: Testing, Adjusting and Balancing.
- H. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA.
- B. Attend construction phase controls coordination meeting.
- C. Attend testing, adjusting, and balancing review and coordination meeting.
- D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. Provide information requested by the CxA for final commissioning documentation.
- F. Mechanical Contractor CxR shall submit approved equipment data sheets on systems to be commissioned to the CxA for review; these will include, but not limited to, the following:
 - 1. Fans.
- G. Control Contractor CxR shall submit all approved equipment data sheets, approved control drawings and approved sequence of operations to the CxA.
- H. TAB Contractor CxR shall submit certification documentation, TAB procedures plan, and preliminary project layout (which shall include an inventory of required flow rates for each air and hydronic system).

1.5 CxA'S RESPONSIBILITIES

- A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Direct commissioning testing.
- C. Verify testing, adjusting, and balancing of Work are complete.
- D. Provide test data, inspection reports, and certificates in Systems Manual.

1.6 COMMISSIONING DOCUMENTATION

- A. Provide the following information to the CxA for inclusion in the commissioning plan:
 - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
 - 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Testing, adjusting, and balancing reports.
9. Laser alignment reports.
10. Vibration testing and analysis reports.
11. Completion report of pipe cleaning, flushing hydrostatic testing and chemical water treatment.

B. The CxA shall provide and include the following documentation:

1. Commissioning plan
2. Pre-installation checklists
3. Pre-startup verification checklists (installation and pre-startup phases)
4. Startup testing and verification checklists (startup phase)
5. Functional performance testing plan with procedures and checklists for each series of tests. Submittals shall include samples of data reporting sheets that will be part of the reports.
6. Final commissioning report

1.7 SUBMITTALS

- A. Certificates of readiness.
- B. Certificates of completion of installation, prestart, and startup activities.

1.8 SYSTEMS TO BE COMMISSIONED

- A. HVAC&R systems and associated control systems:
 1. Air Handling Systems.
 2. HVAC Zone Control Systems
 3. Chilled Water Systems.
 4. Steam and Condensate Systems.
 5. Hot Water Heating Systems.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PRE-INSTALLATION VERIFICATION (PIV)

- A. CxR for respective trade as indicated on PIV form will complete this scope of work; a sample PIV form for each equipment type has been included in Appendix 1 of this specification.
- B. Review approved submittals for equipment included in systems to be commissioned.
- C. Prior to the installation of each piece of equipment, verify that equipment arriving on site is consistent with that required.
- D. The CxA shall carry out a 20% PIV sampling of each piece of equipment.

3.2 PRE-STARTUP VERIFICATION (PSV)

- A. Prior to the installation of each piece of equipment, verify that equipment arriving on site is consistent with that required (ie, verify that the PIV for each piece of equipment has been completed and accepted)
- B. CxR for respective trade as indicated on PSV form will complete this scope of work; a sample PSV form for each equipment type has been included in Appendix 1 of this specification.
- C. Certify that HVAC&R systems, subsystems, and equipment have been installed according to the Contract Documents.
- D. Certify that HVAC&R instrumentation and control systems have been installed, connected, calibrated and are ready for start-up procedures.
- E. Inspect and verify the position of each device and interlock identified on checklists.

3.3 STARTUP TESTING AND VERIFICATION (STV)

- A. Prior to the startup of each piece of equipment, verify that equipment installed is consistent with that required (ie, verify that the PSV for each piece of equipment has been completed and accepted)
- B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

- D. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- E. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.4 TESTING, ADJUSTING AND BALANCING (TAB) VERIFICATION

- A. Testing, adjusting and balancing shall be carried out in direct contract with the Owner.
- B. Prior to performance of TAB Work, provide copy of completed system readiness checklists, preliminary report (comprehensive project layout in electronic format), and certification documentation to the CxA.
- C. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.
- D. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.
 - 1. The CxA will notify testing and balancing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
 - 2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
 - 3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
 - 4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.
- E. Vibration and Sound Tests: Upon completion of TAB Work, the Owner will provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls. Notify CxA at least 10 days prior to testing.

3.5 FUNCTIONAL PERFORMANCE TESTING REQUIREMENTS (FPT)

- A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Prior to the functional performance testing of each piece of equipment, verify that equipment has been correctly brought online and TAB report has been accepted (ie, verify that the STV for each piece of equipment has been completed and accepted)
- C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

- D. All members of the Cx team shall provide technicians, instrumentation, and tools as required in the respective FPT test format (see Appendix 1 for CxR requirements) to perform commissioning test at the direction of the CxA.
- E. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.
- F. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- G. The CxA along with the HVAC&R Subcontractor, testing and balancing Subcontractor, and HVAC&R Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- H. Tests will be performed using design conditions whenever possible.
- I. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- J. The CxA may direct that set points be altered when simulating conditions is not practical.
- K. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- L. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- M. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.6 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the CxA with preparation of testing plans.

END OF SECTION 230800

SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. This section shall apply to all Division 26 sections.

1.2 SUMMARY

- A. Work Included
 - 1. The work shall be executed in conformity with the drawings, the approved shop drawings, and these specifications.
 - 2. In general, this work shall consist of, but not necessarily be limited to the following:
 - 3. Demolition
 - 4. New Work
- B. Work Not Included
- C. The Contractor shall refer to Alternates listed in Division 01 and Proposals and shall submit price quotations for the alternates that apply to the electrical work.

1.3 SUBMITTALS

- A. Shop Drawings and Samples
 - 1. The Contractor shall submit shop drawings for all major equipment including, but not limited to the following items and/or the items listed in Division 26 sections.
 - 2. Quantity of shop drawings and information to be included shall be as specified in Division 01 - General Requirements.
- B. As-Built Drawings
 - 1. Quantity of shop drawings and information to be included shall be as specified in Division 01 - General Requirements.

2. The Contractor shall submit as-built drawings indicating the location of all outlets, junction boxes, and conduit runs; including conduit size, circuit numbers, and number of wires in each run.

C. Certificate of Electrical Inspection: Provide certificate as described in this section.

1.4 QUALITY ASSURANCE

A. Codes and Regulations

1. See Division 01 General Requirements for Codes and Regulations that apply.
2. The latest National Electrical Code shall be observed and shall govern the character of work, style, quantity and the size of all material used.
3. All materials shall conform with the standards of the Underwriter's Laboratories in every case where such standards have been established for the particular type of material in question.
4. All material and equipment shall be UL listed and bear the UL label where such listing and labeling exists.
5. The complete electrical installation shall comply with all the requirements of the M.I.O.S.H.A.
6. Codes shall be used as minimum requirements, and where the Specifications or Plans call for an installation that exceeds and does not violate the Code requirements, the Specifications and Plans shall be followed.

B. Character of Work

1. The installation shall be executed in a workmanlike manner and shall present a neat mechanical appearance when completed.
2. Contractors shall have a minimum of five years of experience working on like systems involved in this project.

C. Permits and Inspections

1. The Electrical Contractor shall obtain and pay for all permits required by the State of Michigan Labor Department, Electrical Division.
2. The Electrical Contractor shall submit, to precede request for final payment, a copy of the Certificate of Electrical Inspection as required by the State of Michigan.

1.5 GUARANTEE

A. Refer to Division 01 - General Requirements.

- B. Refer to individual Division 26 sections for any additional guarantee requirements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Refer to individual Division 26 sections for product specifications.
- B. Material to be Returned to the Owner
 - 1. Refer to Division 01 - General Requirements.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Division 01 - General Requirements for items such as examination of premises, coordination with other trades, cutting and patching, connection to present equipment, etc.
- B. Laying Out Work
 - 1. All exterior light locations shall be staked out by the Contractor and approved by the Engineer prior to installation.
- C. Equipment Supports
 - 1. Enclosures for panelboards, motor starters, motor control centers, and other similar equipment shall be mounted on ½" spacers when mounted in a room on a below grade exterior wall.
- D. Feeders and/or branch circuit wiring shall not pass through electrical equipment such as switchboards, panelboards, disconnect switches, and motor starter enclosures where the power source for that wiring originates in another location.

END OF SECTION 260500

SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. This Section specifies the conductors and cabling for buildings and structures electrical systems under 600 volts. Wiring for fire alarm and communication systems is specified in their respective sections.
 - 2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein.
- B. Related Sections include the following:
 - 1. Applicable sections of Division 26 - Electrical

1.3 SUBMITTALS

- A. cable.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70, “National Electrical Code”
- C. Furnish wire and cable that has been manufactured and factory tested in accordance with ASTM, ANSI, IPCEA, and NEMA.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. All wiring, branch circuits and feeders, 600 volts and below, shall be stranded copper, type THW, THWN, or THHN sized as indicated on the drawing. Aluminum conductors can be used for feeders above 150 amps.
- B. Feeder phase identification from left to right or front to back facing front of equipment shall be one of the following:

| Phase A | Phase B | Phase C | Neutral | System |
|---------|---------|---------|---------|----------------------|
| X | Y | Z | N | Any voltage |
| BLACK | RED | BLUE | WHITE | 120/208 volt feeders |
| BROWN | ORANGE | YELLOW | GRAY | 277/480 volt feeders |

- C. In general, all branch circuit wiring shall be 600 volt type THHN or THWN, minimum wire size number 12 AWG, except where noted otherwise. Branch circuits 100 feet or longer shall be minimum size number 10 wire AWG.
- D. 120 volt control circuits may be number 14 AWG wire.
- E. Neutral conductor insulation color for emergency and “X” panel circuits shall be as noted above with a red tracer.
- F. Cable types MC, MI, NM, NMC, or NMS shall not be used unless specifically noted on the drawings or in the specifications.

2.2 TRAY CABLE

- A. Tray cable shall be three conductor with ground, size as shown on the drawings, UL listed TC for cable tray installation, and comprised of the following:
 - 1. Class B stranded, tinned, annealed copper conductors, each insulated with flame-retardant ethylene propylene rubber (EPR) rated for 90 deg C operation. Each insulated conductor shall be individually identified by color coding to differentiate one phase from the other.
 - 2. The three insulated conductors shall be cabled together with non-hygroscopic, flame-retardant fillers, a bare copper ground conductor with an overall binder tape applied.

3. A flame-retardant chlorinated polyethylene (CPE) jacket shall be applied over the cable assembly.

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- B. Cable shall be manufactured by General Cable, Kerite, or Okonite.

2.3 WIRING CONNECTIONS

- A. Taps and splices in all feeder and branch circuit conductors larger than no. 8 AWG shall be made with approved solderless, pressure type bolted connectors. Splices in conductors no. 8 AWG and smaller may be made with preinsulated Scotchlock or Ideal Wing-Nut spring tension connectors.
- B. Termination of motor leads to branch circuit conductors shall be made with Burndy Clear UNITAP inspectable insulated multiple tap connectors sized for the conductors being terminated.

PART 3 - EXECUTION

3.1 CONDUCTORS

- A. All wiring shall be installed in rigid galvanized conduit, intermediate metal conduit (I.M.C.), flexible conduit, electrical metallic tubing (E.M.T.) or other approved raceway.
- B. Pulling compounds shall be compatible with the cable being installed in accordance cable manufacturer's recommendations.
- C. A shared neutral between branch circuits shall not be used for single phase, phase-to-neutral loads at either 120 volts or 277 volts.
- D. Neutral conductors in junction boxes, pull boxes, outlet boxes, etc. shall be identified with the associated phase conductor circuit number.

END OF SECTION 260519

SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. This Section specifies the grounding and bonding of electrical systems for buildings and structures.
 - 2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein.
- B. Related Sections include the following:
 - 1. Applicable sections of Division 26 - Electrical

1.3 SUBMITTALS

- A. Grounding test reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70, “National Electrical Code”
- C. Comply with applicable requirements of U.L. Standards 467 pertaining to electrical grounding and bonding. Provide grounding products that are U.L. listed and labeled.

PART 2 - PRODUCTS

2.1 GROUND RODS

- A. Ground bus shall be solid 98% conductivity, electrical grade copper.

2.2 CONDUCTORS USED FOR GROUNDING

- A. Conductors used for grounding shall be stranded copper, THWN/THHN, the same as the feeder conductors and/or branch circuit conductors. Conductors buried in concrete shall have RHW or THW insulation.
- B. Grounding conductors shall have green insulation the entire length. Isolated grounding conductors shall have green insulation with a yellow tracer the entire length.

PART 3 - EXECUTION

3.1 TRANSFORMER VAULTS AND MAIN ELECTRICAL ROOMS

A. Ground Bus

- 1. A 1/4 inch x 2 inch x 8 foot ground bus shall be installed approximately 12 inches above the floor. All joints shall be thoroughly cleaned and trimmed on both sides and edges, wiped smooth and bright, and bolted in approved manner.

B. Ground Connections

- 1. From the ground bus in the electrical room, run two ground cables to the ground rods located on the drawing and one ground cable to cold water main. Provide jumpers at all water meters. Provide ground cable from ground bus to underground duct system ground. All ground cable shall be 4/0 AWG THW, stranded copper.
- 2. All conduit, pipe racks, switches, supports, wiring troughs, cable sheaths, cabinets, transformers, special equipment, and non-current carrying parts shall be permanently and effectively grounded to one of these ground systems.
- 3. Make ground connections at equipment with grounding devices manufactured for this purpose equal to Burndy Engineering Co. fittings. No soldered ground connections shall be used on grounding circuits at any point, except where ground conductor is attached to the lead sheathed cables. Primary grounds and secondary neutral shall be connected to ground bus with approved mechanical connectors.
- 4. Primary and secondary neutrals of transformers shall be connected to the ground bus with approved mechanical connectors.
- 5. An equipment grounding conductor shall be installed with feeders and branch circuits and connected to all devices and equipment.
- 6. Conductors used for grounding that are installed separately in electrical rooms or other locations shall be installed in conduit in areas where they are subject to physical damage. The conduit shall be bonded to the conductor.

3.2 COMMUNICATION ROOMS

- A. Install a 1/4" X 2" X 24" copper ground bus with predrilled holes on the two longest walls of all communication rooms.
 - 1. Connect each cable tray and equipment cabinet/rack to the ground bus each with a #6 AWG green insulated conductor.
- B. Main Communication Rooms
 - 1. Bond each ground bus of the Telephone Utility Room, Broadband Utility Room, and User Communication Room together with a No. 4 AWG THWN/THHN bonding conductor in conduit.
 - 2. Install a No. 4 AWG THWN/THHN grounding conductor in conduit from the ground bus in the Telephone Utility Room to the ground grid in the main electrical room.
 - 3. Install a separate isolated ground bus and No. 4 AWG THWN/THHN isolated grounding conductor in conduit from the Telephone Utility Room to the ground grid in the main electrical room.
- C. Floor Communication Rooms
 - 1. Stand-Alone Communication Rooms
 - a. Connect each ground bus of stand-alone Floor Communication Rooms or User Floor Communication Rooms with a No. 4 AWG THWN/THHN grounding conductor in conduit to the ground grid in the main electrical room.
 - 2. Side-by-Side Communication Rooms
 - a. Bond the ground bus in side-by-side Floor Communication Rooms and User Floor Communication Rooms with a No. 4 AWG THWN/THHN bonding conductor in conduit.
 - b. Install a No. 4 AWG THWN/THHN grounding conductor in conduit between the ground bus in each Floor Communication Room, and install a No. 4 AWG THWN/THHN grounding conductor in conduit from the ground bus in the Floor Communication Room nearest the Telephone Utility Room to the ground bus in the Telephone Utility Room.

3.3 Other Building Spaces

- A. Install a 1/4 x 2 inch solid copper ground bus with predrilled holes where shown on the drawing. Length shall be 12" or longer as noted on the drawings. Connect each ground bus with a No. 4 AWG THWN/THHN grounding conductor in conduit to the ground grid in the main electrical room.

3.4 Grounding Conductors in Conduit

- A. A grounding conductor shall be installed in all conduits and raceways containing lighting and/or power circuits. Size the grounding conductor per the NEC for the associated circuit unless noted otherwise on the drawings.

END OF SECTION 260526

SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

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. This Section specifies the raceway, conduit, boxes, fittings, multioutlet assemblies, etc. for buildings and structures electrical systems.
 - 2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein.
- B. Related Sections include the following:
 - 1. Applicable sections of Division 26 - Electrical

1.3 SUBMITTALS

- A. Shop Drawings
 - 1. Surface raceway.
 - 2. Multioutlet assemblies.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70, “National Electrical Code”

PART 2 - PRODUCTS

2.1 GENERAL INFORMATION

- A. All boxes, brackets, bolts, clamps, etc., shall be galvanized, electro-galvanized, metalized, or sherardized.
- B. All hardware used outdoors shall be hot dipped galvanized.
- C. Pull boxes, junctions boxes, and outlet boxes installed outdoors shall be heavy duty die cast aluminum construction powder coat finished with gasketed cover plate.

2.2 CONDUIT

- A. Rigid galvanized conduit shall be installed in poured concrete slabs, walls and partitions. Rigid or I.M.C. shall be installed in damp locations and inaccessible places.
- B. All rigid conduit, I.M.C. and E.M.T. shall be hot dipped galvanized, sherardized, metalized or electro-galvanized.
- C. In locations where rigid or IMC conduit cannot be turned and a fitting is required, three piece malleable iron/steel rain-tight fittings shall be used.
- D. E.M.T. may only be installed exposed, above suspended ceilings, or in partitions.
- E. Flexible metal conduit may be used for short runs, up to a length of six feet, to individual pieces of equipment.
- F. Flexible metal conduit and flexible metallic tubing may be used for light fixture whips up to a length of six feet.
- G. Liquidtight flexible metal conduit shall be used for short runs, up to a length of six feet, to individual pieces of equipment in mechanical rooms, penthouses, on roofs, water softener areas and other similar locations.
- H. MC (metal clad) 2 conductor with ground cable can be used for lighting fixture whips.
- I. MC (metal clad) whips with 2#12 conductors & #12 ground conductor and 2#16 conductors can be used for lighting fixture whips for LED lighting fixtures with low voltage dimming. Lighting fixture whips shall be AFC LW4H3S62E46-00 or approved equal.
- J. All conduit 2-1/2 inches and larger shall be rigid or I.M.C.
- K. No E.M.T. or aluminum conduit shall be used in concrete or direct burial, nor in water softener areas or similar corrosive locations.
- L. Aluminum conduit may only be used in sizes 1-1/2 inch and larger. No aluminum conduit will be permitted in concrete. When aluminum conduit is used, all bends shall be galvanized steel.

- M. Size and type of conduit shall comply with the National Electric Code. Where conduits are indicated on the drawing to be larger than required by Code, the larger conduit shall be used.
- N. All conduit used for fire alarm system wiring shall have a red topcoat to identify it as fire alarm system.
- O. All conduit used for life safety systems such as emergency lighting, shall have a green topcoat to identify as life safety.
- P. Minimum conduit size shall be 3/4 inch for all feeder and branch circuit conduits to all panels, junction boxes, pull boxes, and outlets.
- Q. Short runs of exposed conduit to individual pieces of equipment may be one-half inch.
- R. Minimum conduit size shall be one-half inch for low-voltage control wiring.
- S. Where metal conduit is buried underground outside the building walls, to signs, exterior lights, etc., it shall be not less than 1 inch regardless of wire size.

2.3 PULL AND JUNCTION BOXES

- A. All pull boxes shall be galvanized sheet steel, sized as required, with thickness not less than no. 14 gauge.
- B. All pull and junction boxes used for fire alarm system wiring shall have a red cover plate.

2.4 OUTLET BOXES

- A. All outlets, except as otherwise specified, shall consist of approved galvanized steel boxes of pattern adapted to the special requirements of each outlet, securely fastened in place in an approved manner.
- B. Where necessary to run exposed on existing walls and/or ceilings in finished areas, use surface raceway series type, as required for each individual circuit, or as shown on drawing. Paint the new surface raceway to match the existing surface.
- C. Surface raceway shall be Wiremold, Mono-Systems, or Hubbell.

2.5 MULTI-OUTLET ASSEMBLIES

- A. Multi-outlet assemblies shall be Wiremold Plugmold series 3000 with receptacles, couplings, entrance and end fittings necessary for a complete installation, as shown on the drawing.
- B. Receptacles for plugmold shall be 15 ampere, 125 volt, 3 wire grounding type, Wiremold catalog no. 2127GA.
- C. 15 ampere, 250 volt, 3 wire grounding type receptacle shall be Wiremold catalog no. 2127GB.

- D. The length of plugmold, number of outlets, spacing of outlets on centers, and mounting height shall be as shown on the drawing.
- E. Mono-Systems and Hubbell are an approved equal to Wiremold.

2.6 TWIN-DUCT

- A. Twin-duct shall be Wiremold series 3000 with divider strip and furnished with catalog no. G-3007 C-1 or C-2 device mounting plates, couplings, entrance and end fittings necessary for a complete installation, as shown on the drawing.
- B. Mono-Systems and Hubbell are an approved equal to Wiremold.

2.7 PANCAKE

- A. Pancake shall be Wiremold series 1500 with receptacles, couplings, entrance and end fittings necessary for a complete installation, as shown on the drawing.
- B. Receptacles for pancake shall be 15 ampere, 125 volt, 3 wire grounding type, Wiremold catalog no. 1543GL.
- C. The length of pancake, number of outlets, spacing of outlets, and mounting shall be as shown on the drawing.
- D. Mono-Systems and Hubbell are an approved equal to Wiremold.

PART 3 - EXECUTION

Use approved conduit hangers and support conduit in a neat and orderly manner regardless of location.

Conduit installed in steam tunnels shall be anchored with "Hilti" type anchors. Plastic anchors shall not be used.

3.1 CONDUIT

- A. Conduit shall be concealed in all new walls and run above suspended ceilings.
- B. Channel existing plaster walls and/or ceilings to conceal conduit in finished areas.
- C. In lieu of channeling existing plaster walls and where lay-in ceilings are used, flexible metal conduit of minimum size 3/4" may be installed from a switch or receptacle outlet up to a junction box located above the lay-in ceiling. In this instance, the conduit length may exceed six feet.

Note information to be shown on drawing.

- D. Use Wiremold where necessary to run exposed on existing walls and/or ceilings in finished areas as shown on the drawings.

If finished surfaces are not to cut and patched use surface raceway.

- E. Use Wiremold where necessary to run exposed on existing walls and/or ceilings in finished areas.
- F. Provide one spare 1 inch conduit up and one down, to ceiling space, from each new flush panel.
- G. All conduits shall be fastened or suspended from structural members, slabs, or walls only. It shall not be run on or fastened to tee bars of suspended lay-in ceilings.
- H. All conduits shall be supported by approved hangers.
- I. Conduit shall be terminated with locknuts and bushings in all outlet boxes and panels. Insulated bushings shall be used on all rigid conduits 1-1/4 inch and larger. Use insulated bushings and connectors on all E.M.T. All conduit connectors and couplings shall be galvanized steel; cast connectors and couplings are not acceptable.
- J. Threaded couplings, connectors, and conduit bodies shall be used on rigid galvanized conduit and intermediate metal conduit; set screw or threadless types are not acceptable.
- K. All conduits run exposed shall be run parallel to the structural members of the building in a neat manner, securely fastened in place. Approved conduit type fittings or outlet boxes shall be used at all bends in a vertical plane or where breaking around beams or columns. Bends on ceilings in a horizontal plane shall be made with long sweep ells. Paint all exposed conduit in finished areas to match existing finishes.
- L. All conduits penetrating underground walls into basements, crawlspaces, vaults, etc. shall be sealed between the conduits and walls with Link-Seal Model "C" modular sealing system.

3.2 PULL AND JUNCTION BOXES

- A. Pull boxes shall not be installed in inaccessible locations.
- B. In general, pull or junction boxes shall be used in conduit runs when the number of bends in the conduit run exceeds 360 degrees. When conduits are installed in a bank, conduit bodies may be utilized due to space limitations.

3.3 SURFACE RACEWAY AND MULTIOUTLET ASSEMBLIES

- A. All joints and corners shall be tight with no gaps or spaces.

- B. Raceway and assemblies shall be securely fastened to surface such that it cannot be moved.

3.4 MOUNTING UNDER ROOF DECKS

- A. Conduit and raceways systems shall not be mounted directly to the underside of roof decks or installed through the webbing, flutes, or ribs of the roof deck support system.
- B. Conduit and raceway systems shall be attached to the bottom of the structural elements supporting the roof deck.

END OF SECTION 260533

SECTION 260800 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes commissioning process requirements for electrical systems, assemblies, and equipment.
- B. Related Sections:
 - 1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.
- C. Start up of equipment and systems such as medium voltage switches, transformers, unit substations, emergency power and lighting systems, etc. shall be done by or with a trained manufacturer's representative who can check and report on all items such as installation, operation, and see that the equipment or system starts and operates properly.
- D. Testing shall be performed at the convenience of the Owner and with the Owner's representatives present and the manufacturer's representative of the equipment and/or system present.

1.3 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.
- C. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 ALLOWANCES

- A. Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing are covered by the "Schedule of Allowances" Article in Division 01 Section "Allowances."

1.5 UNIT PRICES

- A. Commissioning testing allowance may be adjusted up or down by the "List of Unit Prices" Article in Division 01 Section "Unit Prices" when actual man-hours are computed at the end of commissioning testing.

1.6 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA.
- B. Attend construction phase controls coordination meeting.
- C. Attend testing, adjusting, and balancing review and coordination meeting.
- D. Participate in electrical systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. Provide information requested by the CxA for final commissioning documentation.
- F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.7 CxA'S RESPONSIBILITIES

- A. Provide Project-specific construction checklists and commissioning process test procedures for actual electrical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Direct commissioning testing.
- C. Verify testing and adjusting of Work are complete.
- D. Provide test data, inspection reports, and certificates in Systems Manual.

1.8 COMMISSIONING DOCUMENTATION

- A. Provide the following information to the CxA for inclusion in the commissioning plan:
 - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
 - 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
 - 3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for electrical systems, assemblies, equipment, and components to be verified and tested.
 - 4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.

5. Certificate of readiness certifying that electrical systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing and adjusting reports.

1.9 SUBMITTALS

- A. Certificates of readiness.
- B. Certificates of completion of installation, prestart, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

- A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify that electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify that testing and adjusting procedures have been completed and that testing and adjusting reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 TESTING VERIFICATION

- A. Prior to performance of testing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

- B. Notify the CxA at least 10 days in advance of testing Work, and provide access for the CxA to witness testing Work.
- C. Provide technicians, instrumentation, and tools to verify testing of electrical systems at the direction of the CxA.
 - 1. The CxA will notify testing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
 - 2. The testing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
 - 3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing and adjusting report.
 - 4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of electrical testing shall include all components, equipment, and systems as outlined in outlined later in this section.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response to input signals.
- D. The CxA along with the Electrical Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

3.4 MEDIUM-VOLTAGE CABLE

- A. High potential and megger tests shall be made of the completed circuit and the high potential test results plotted.
- B. The high potential tests shall be made in accordance with current industry standards. The test voltages, voltage increments, and time intervals shall be as follows:
 - 1. Installation test
 - 30 kV test voltage
 - 3 kV step increase from 0 to 30 kV
 - 15 minutes at 22.5 kV
 - 2. Maintenance proof test
 - 22.5 kV test voltage
 - 3 kV step increase from 0 to 22.5 kV
 - 5 minutes at 22.5 kV

3.5 EMERGENCY POWER SYSTEMS

- A. Emergency power systems shall be tested under load by deenergizing the normal power feeders to verify proper transfer. All of the alarm systems will be tested to verify proper operation. The starting battery will be tested to ensure compliance with the manufacturer's specifications.

3.6 LIGHTING DIMMING AND CONTROL SYSTEMS

- A. All dimming systems shall be operated throughout its entire range with all functions operated to verify proper operation.
- B. All occupancy sensors shall be tested for proper operation over the entire intended zone of coverage.

END OF SECTION 260800

SECTION 260923 – LIGHTING CONTROL DEVICES

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. This Section specifies the dimming control and occupancy sensors for lighting systems as shown and the drawing and specified herein for buildings and structures.
 - 2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein.
 - 3. The Contractor shall furnish and install a complete dimming control system and occupancy sensor system, as shown on the drawing and specified herein.
- B. Related Sections include the following:
 - 1. Applicable sections of Division 26 – Electrical

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Dimming control systems
 - 2. Occupancy sensors
- B. Operation and Maintenance Data:
 - 1. Dimming control systems
 - 2. Occupancy sensors

1.4 QUALITY ASSURANCE

- A. Wall box dimmers, occupancy sensors, and dimming systems shall comply with all applicable Underwriters Laboratory and ANSI/IEEE Standards.
- B. Dimming systems:

1. Equipment shall be fully tested for proper operation prior to shipment from the factory.

PART 2 - PRODUCTS

2.1 OCCUPANCY SENSORS

- A. Wall box occupancy sensors for small offices, storage rooms, copy rooms, etc. shall be:
 1. Lutron MSA102 (single relay) for single level lighting and MSA202 (dual relay) for two level lighting
 2. Wattstopper DW-100 (single relay) for single level lighting and DW-200 (dual relay) for two level lighting.
 3. Hubbell Building Automation LHMTS (single relay) for single level lighting and LHMTD (dual relay) for two level lighting.
- B. Wall box occupancy sensor/dimmer for small offices and personal care restrooms shall be:
 1. Lutron MS-Z-101W.
 2. Legrand DW-311-W.
- C. Ceiling mount occupancy sensors for large offices and conference rooms shall be:
 1. Leviton OSW/OSC sensor and a OPP20-OD2 power pack.
- D. The lighting controls for wallbox occupancy sensor/switch and ceiling mounted occupancy sensors with power packs are shown in the lighting control details. See the MSU construction standards website for these details to be used on campus. See 3.1.G. for a listing of the interior lighting details

2.2 WALLBOX DIMMERS

- A. Wall box dimmers shall be U.L. listed for the required lighting load and shall be capable of operating at full capacity with no adverse effect to the dimmer.
- B. Dimmers shall incorporate power failure memory. Should power be interrupted and subsequently restored, the lights will come on to the level they were set at prior to the power interruption.
- C. Dimmers shall be equipped with RFI filters.
- D. Dimmer faceplate shall snap on the device with no visible means of attachment. At locations with multiple dimmers, one seamless, multigang faceplate shall be provided. Faceplate finish shall be Ivory.
- E. LED Dimmers

1. LED wall box dimmers shall be Lutron DVSTV-WH for use with 0-10V LED drivers.
2. LED wall box dimmers shall be Leviton IP-710-LFZ-WH for use with 0-10V LED drivers.

2.3 SYSTEM DIMMERS

2.4 DAYLIGHT HARVESTING

- A. Continuous, closed loop, 0-10v dimming shall be used for all LED lighting fixtures on campus.
- B. Daylight sensors for continuous dimming shall be Watt Stopper LS-301 with LSR-301-S power pack.
- C. Daylight sensors for step dimming shall be Watt Stopper LS-102 with BZ-50 power pack.
- D. Daylight sensors shall be calibrated as follows:
 1. Continuous dimming in areas of 40-50 foot candle = 65 – 110 foot candle approx. range
 2. Continuous dimming in areas of 15 foot candle = 25 – 40 foot candle approx. range

PART 3 - EXECUTION

3.1 OCCUPANCY & DAYLIGHT SENSORS, DIMMERS AND ROOM CONTROLLERS

- A. When occupancy sensor power packs are used they shall be mounted above the ceiling adjacent to one of the sensors and wired to the sensors with minimum 18 AWG multi-conductor low-voltage cable. In hard ceilings install an access panel having the same rating as the ceiling to access the power pack. Install low-voltage cable per NEC.
- B. All control circuits – individual conductors or cables – shall be installed in conduit, basket or ladder style cable tray, or J-hooks. J-hooks to be spaced at 36” maximum intervals with a cable sag of less than 6”. Closer spacing may be necessary when cables are routed around corners or in close proximity to other mechanical and electrical systems. J-hooks to be 2” Doc Industries JH32 or equal.
- C. Ceiling mount occupancy sensors shall be installed at approx. 70% of the rated distance to ensure adequate coverage on campus. The occupancy sensor rated distances shall be the following:
 1. Wattstopper DT-200/DT300 ceiling mounted occupancy sensor adjusted distance = 25’.
 2. Leviton OSW/OSC ceiling mounted occupancy sensor adjusted distance = 25’.
 3. Wattstopper LMDX/LMDC ceiling mounted occupancy sensor adjusted distance = 20’.
 4. Greengate OAWC/OAC ceiling mounted occupancy sensor adjusted distance = 20’.

- D. Install occupancy sensor power packs above a lay-in ceiling close to the lighting switch. If there is a plaster ceiling or metal spline ceiling system, install the power pack as close as possible to the lighting switch.
- E. Contractor shall furnish and install all equipment, labor, system setup, and other services necessary for the proper installation of the devices as indicated on the drawings and specified herein. System setup shall include defining each dimmers load type, assigning each load to a module, and setting the functions of the controls.
- F. The following table describes the intended occupancy control for the various areas on campus.

| SPACE TYPE | 9.4.1.1. b RESTRICTED TO MANUAL ON | 9.4.1.1. b EXCEPTION OF 50% AUTO ON | 100% AUTO ON | 100% AUTO ON PDC SAFETY AND SECURITY EXCEPTION | 9.4.1.1. d BI-LEVEL CONTROL |
|---|-------------------------------------|--------------------------------------|--------------|--|------------------------------|
| 1. AUDIENCE SEATING AREA - ALL TYPES, NOTE 1 | NO | YES | | | YES |
| 2. CLASSROOM/LECTURE HALL/TRAINING ROOM, NOTE 2 | NO | YES | | | YES |
| 3. CONFERENCE/MEETING/MULTIPURPOSE ROOM, NOTE 2 | NO | YES | | | YES |
| 4. COPY/PRINT ROOM | YES | | | | YES |
| 5. CORRIDOR, NOTE 3 | NOT REQD | | YES | | NOT REQD |
| 6. COMPUTER ROOM | AUTO ON SAFETY | | YES | YES | YES |
| 7. RESEARCH OR CLASSROOM LAB, NOTE 4 | NOT REQD | | YES | YES | YES |
| 8. LOBBY, NOTE 2 | NO | YES | | | YES |
| 9. LOCKER ROOM | AUTO ON SAFETY | | YES | YES | YES |
| 10. OPEN OFFICE, NOTE 2 | NO | YES | | | YES |
| 11. ENCLOSED OFFICES | YES | | | | YES |
| 12. RESTROOMS | NOT REQD | | YES | | NOT REQD |
| 13. STAIRWELLS, NOTE 3 | NOT REQD | | YES | | YES |
| 14. STORAGE ROOMS | YES | | | | NOT REQD |
| 15. OTHER AREAS ON CAMPUS NOT LISTED, NOTE 7 | | | | | |

| 9.4.1.1. a LOCAL CONTROL | See Design GL |
|--------------------------------------|---------------|
| 9.4.1.1. c RESTRICTED TO PARTIAL ON | Not used |
| 9.4.1.1. g AUTO PARTIAL OFF | NOTE 5 |
| 9.4.1.1. h AUTO FULL OFF | NOTE 5 |
| 9.4.1.1. i SCHEDULED SHUT OFF | NOTE 6 |

NOTES:

1. LARGE AUDITORIUMS WILL HAVE A LIGHTING CONTROL SYSTEM OR BAS.
2. ROOM CONTROLLERS TO PROVIDE 50% AUTO ON LOGIC.
3. NL LIGHTS TO PROVIDE 1FC MIN IN UN-OCCUPIED STATE. SEE MBC 2015
4. INSTALL OCCUP SENSORS IN LABS.
5. AUTO FULL OFF IS USED IN PLACE OF PARTIAL OFF.
6. OCCUP SENSOR SIGNAL IS USED IN PLACE OF TIME OF DAY SHUTOFF.
7. VERIFY LIGHTING OPERATION WITH ATHLETICS, RHS OR OTHER AREAS.

- G. The following index is the listing of the interior lighting details to be used at MSU.

SECTION 262400 – SWITCHBOARDS, PANELBOARDS, AND CONTROL CENTERS

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. This Section specifies the switchboards, panelboards, and motor control centers for buildings and structures.
- 2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein for a complete operating system.

- B. Related Sections:

- 1. Applicable sections of Division 26 - Electrical

1.3 SUBMITTALS

- A. Shop Drawings

- 1. Panelboards

- B. Operation and Maintenance Data

- 1. Panelboards

1.4 QUALITY ASSURANCE

- A. Comply with NEC Article 384 as applicable to the installation of panelboards, cabinets, and cutout boxes.
- B. Comply with applicable requirements of Std. No. 67 “Electric Panelboards”, and Stds. No. 50, 869, 486A, and 1053 pertaining to panelboards, accessories and enclosures. Provide units that are U.L. listed and labeled.
- C. Where indicated or used, provide service entrance type equipment and accessories and label “SUITABLE FOR USE AS SERVICE EQUIPMENT”. Provide all service entrance features per NEC and U.L.

- D. Comply with NEMA Stds. Pub./No. 250 “Enclosure for Electrical Equipment (1000 Volts Maximum)”, Pub./No. PB 1 “Panelboards”, and Pub./No. PB 1.1 “Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less”.

PART 2 - PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

- A. The Contractor shall furnish and install, at locations shown on the drawing, approved distribution panels equipped as indicated on the riser diagram.

Use the following item when distribution panels are to be fuse type. Use fuse type only on circuits 200 amps and smaller. All larger circuits should be circuit breaker.

1. .

Use the following item when distribution panels are to be circuit breaker type.

- B. Circuit breaker type
1. Circuit breaker interrupting capacity shall not be less than 42,000 amperes symmetrical at 240 volts and 25,000 amperes symmetrical at 480 volts.
 2. Circuit breaker panels shall be Cutler-Hammer type Pow-R-Line 4, General Electric CCB, Square D I-Line, or approved equal by Siemens.
- C. Panels shall be surface mounting or flush mounting as shown on drawing, dead front construction, and enclosed in Code gauge galvanized steel.
- D. Panels shall be of voltage and main lug rating as shown on the drawing.
- E. Bus bars shall be copper and figured on the basis of 1000 amperes per square inch of cross sectional area for copper, and 500 amperes per square inch for lugs and connections. All busses shall be copper.
- F. Panels shall be equipped with fully rated neutral bars.
- G. Lugs shall be of sizes to suit the corresponding feeders as indicated on the riser diagram.
- H. Each circuit shall be provided with an engraved laminated plastic nameplate indicating the circuit controlled.
- I. Each panel shall have a panel designation as indicated on drawing engraved on laminated plastic and fastened to outside of door. Panels without doors shall have designation fastened at top of panel front.

- J. Door and cover of panels in finished areas shall be furnished with prime coat of paint and shall be painted by the General Contractor to match adjacent area. Door and cover of panels in unfinished areas shall be furnished with standard factory finish. Upon completion of job, Electrical Contractor shall touchup all spots where factory finish has been marred, using paint supplied by the factory.

2.2 LIGHTING PANELBOARDS

- A. Furnish and install thermal magnetic, quick-make, quick-break, plug-in type circuit breakers in existing branch panel, ampere rating and number of poles as indicated on drawing. Circuit breakers shall have a minimum interrupting capacity of 10,000 amperes symmetrical, as manufactured by Cutler Hammer or General Electric.
- B. The Contractor shall furnish and install surface or flush mounting branch lighting panels where noted and shown on the drawing. Panels shall be dead front construction, enclosed in code gauge galvanized steel box with hinged steel door.
- C. Panels shall be equipped with 120/240 volt 1 and 2 pole, or 240 volt 3 pole, thermal magnetic quick-make, quick-break, plug-in type circuit breakers, size and quantity as indicated on drawing. Two and three pole breakers shall be common trip. Circuit breakers shall have minimum interrupting capacity of 10,000 amperes symmetrical.
- D. Bus bars shall be copper and figured on the basis of 1000 amperes per square inch of cross sectional area for copper, and 500 amperes per square inch for lugs and connections. All busses shall be copper.
- E. Panel fronts shall be equipped with concealed hinges and semiflush Corbin catalog no. 15751 catch, lock, and no. TEU-1 key.

Select the following paragraph if the completion date does not allow for factory installed Corbin locks and keys.

- F. Panel fronts shall be equipped with concealed hinges. Lock and latch not required.
- G. Panels shall be provided with a directory frame, minimum of 5 inches wide and 12 inches long. All circuits shall be catalogued on typewritten directory cards.
- H. Each breaker serving a computer circuit shall be protected with a breaker lock to prevent accidental de-energizing.
- I. Each breaker serving a bedroom or dorm shall be AFCI rated
- J. Catalog all new or reworked circuits in existing branch panels.
- K. Branch panels shall have panel designation engraved on black and white laminated plastic, white letters on black back ground, and fastened to outside of door.
- L. Door and cover of panels in finished areas shall be furnished with prime coat of paint and shall be painted by the General Contractor to match adjacent area. Door and cover of panels in

unfinished areas shall be furnished with standard factory finish. Upon completion of job, Electrical Contractor shall touch up all spots where factory finish has been marred, using paint supplied by the factory.

- M. The panel shall have a hinged front cover with the entire front trim hinged to the box with a standard door within the hinged trim cover.
- N. Panels shall be 120/208 volt, 3 phase, 4 wire, solid neutral with copper busses and main lugs, rating as shown on drawing such as Cutler-Hammer POW-R-LINE 1, General Electric AL, Square D NQOD, or approved equal by Siemens.

2.3 MOTOR CONTROL CENTERS

A. General

1. Motor control centers shall be built in accordance with all applicable NEMA Standards, ANSI Standards, and U.L. requirements. Voltage, amperage, and phases shall be as shown on the drawing. Main lugs or lugs for main breaker units shall be provided to accommodate feeders as shown on the drawings. The entire motor control center shall be built to withstand an available fault of 50,000 RMS symmetrical amperes
2. The motor control center shall be wired NEMA Class I, Type B.
3. Structures shall be totally enclosed, deadfront, free standing assemblies, 90 inches high. Removable lifting angles shall be provided. Structures shall be fabricated from minimum 12 ga. Steel.
4. Structures shall contain a horizontal wireway at the top, isolated from horizontal bus and readily accessible. Each structure shall contain an isolated vertical wireway with cable supports, accessible through hinged doors and a horizontal wireway at the bottom. All structure and unit doors to be mounted concealed hinges and secured with quarter turn indicating type fasteners. Structure enclosure shall be NEMA 1A (all doors gasketed).
5. Main horizontal bus shall have an ampacity as shown on the drawings. Vertical bus shall have a minimum ampacity sufficient to accommodate the maximum load of a vertical section of starters and/or disconnect switches, but shall not be less than 300 amperes. A ground bus with a minimum ampacity of 300 amperes shall be installed in each section and shall run the entire length of the center when assembled. All bus bars shall be tin plated copper. The entire bus assembly shall be completely enclosed within grounded steel barriers with insulated cutouts provided for the stab connections to the vertical bus.

B. Units

1. Combination starter units shall be furnished with the following components as specified or shown on the drawings:

- a. Fused disconnect or circuit breaker (as shown on drawing) with interlock defeater for maintenance purposes;
 - b. 120 Volt control transformer, fused;
 - c. Pilot lights in cover as shown on drawing;
 - d. Holding coil rated 120 volts;
 - e. Selector switch in cover as shown on drawing;
 - f. Stop-Start buttons in cover as shown on drawing;
 - g. Overload protection and number of auxiliary contacts needed for each application on motor starters;
 - h. Disconnect switch electrical interlock where indicated.
2. Motor starters shall be a minimum NEMA Size 1.
 3. Fused disconnect switch units, circuit breaker units, and combination motor starter units shall have the disconnect and the door interlocked to prevent the unit door from being opened when the unit is on. The interlock shall have a defeater for maintenance purposes.
 4. Starters for all motors 20 HP and larger shall include time delay relays to provide an adjustable time delay on starting from 0 to 3 minutes.
 5. Motor control centers shall be Square D Model 5, Siemens Model 95, or equal by General Electric, Cutler-Hammer, or Allen Bradley.

PART 3 - EXECUTION

3.1 EQUIPMENT SUPPORTS

- A. Electrical equipment shall be mounted on ½" spacers when mounted in a room on a below grade exterior wall.

END OF SECTION 262400

SECTION 262726 – WIRING DEVICES

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. This Section specifies the wiring devices for buildings and structures.
 - 2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein.
- B. Related Sections include the following:
 - 1. Applicable sections of Division 26 - Electrical

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Switches
 - 2. Receptacles
 - 3. Receptacle and switch cover plates
 - 4. Relays
 - 5. Time switches

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70, “National Electrical Code”

PART 2 - PRODUCTS

2.1 SWITCHES

- A. Switches, single, 2 pole, 3 way, 4 way and key type, shall be lifetime quite type, Cooper 2200 series, Hubbell HBL1200 series, Leviton 1200 series, or equal P. and S., color brown.
- B. Switch and pilot light combination shall consist of switch, Cooper 2200 series, and a flush neon pilot light, 125 volt with red plastic jewel, Cooper 277 or Leviton catalog no. 5336.
- C. Switch and pilot light combination shall be Leviton catalog no. 5226, 15A., 120 VAC single pole switch and 1/25W, 125V. neon pilot light, red jewel face.
- D. Presswitch single, 2 pole, 3 and 4 way, shall be Hubbell 1200 series, color brown.
- E. Three position, two circuit, momentary contact switches shall be such as Hubbell catalog no. 1556, 15A., 120-277V. color brown or equal Cooper, Leviton, or P. and S.

2.2 RECEPTACLES

- A. In general, duplex receptacles shall be 20 ampere, 125 volt, 3 wire, grounding type, heavy duty, specification grade, color brown. Receptacles shall be:
 - 1. Cooper 5362
 - 2. Hubbell HBL5362
 - 3. Leviton 5362
 - 4. Pass and Seymour 5362A
- B. 15 ampere, 125 volt, 3 wire grounding type duplex receptacles shall be heavy duty, specification grade, color brown. Receptacles shall be:
 - 1. Cooper 5262
 - 2. Hubbell HBL5262
 - 3. Leviton 5262
 - 4. Pass and Seymour 5262A
- C. Ground fault circuit interrupter receptacles shall be self-testing, specification grade 20 ampere, 125 volt, with feed through, color brown. GFCI receptacles shall be:
 - 1. Eaton TWRSGF20FB
 - 2. Leviton G5362-OWT
- D. 15 ampere, 125 volt, 3 wire duplex receptacles with isolated ground, shall be Hubbell catalog no. IG-5262, Leviton catalog no. 5262-IG, Cooper catalog no. IF5262, or equal P. & S.
- E. 15 ampere, 125 volt, 3 wire, grounding type with transient voltage surge suppressor for computer outlets, shall be Leviton catalog no. 5280.

- F. 20 ampere, 250 volt, 3 wire twist-lock receptacle, shall be Hubbell catalog no. 2320, Leviton catalog no. 2320, or equal Cooper or P. & S.
- G. 30 ampere, 125 volt, 2 pole, 3 wire receptacle shall be such as Hubbell catalog no. HBL9308, Leviton catalog no. 5371, or equal Cooper or P. & S.
- H. 30 ampere, 125 volt, 2 pole, 3 wire twist-lock receptacle with isolated ground, shall be Hubbell catalog no. IG-2610, Leviton catalog no. 2610-IG, or equal Cooper or P. & S.
- I. 30 ampere, 250 volt, 2 pole, 3 wire receptacle shall be such as Hubbell catalog no. HBL9330, Leviton catalog no. 5372, or equal Cooper or P. & S.
- J. 30 ampere, 250 volt, 2 pole, 3 wire twist-lock receptacle, shall be Hubbell catalog no. 2620, Leviton catalog no. 2620, or equal Cooper or P. & S.
- K. 15 ampere, 250 volt, 3 wire grounding type, single receptacle for window a.c. unit shall be Hubbell catalog no. 5652 or Leviton catalog no. 5661.
- L. 20 ampere, 250 volt, 3 wire, single receptacle for window a.c. unit shall be Hubbell catalog no. 5461 or Leviton catalog no. 5461.
- M. 20 ampere, 250 volt, 2 pole, 3 wire, single phase, duplex receptacle shall be Hubbell catalog no. 5462 or Leviton catalog no. 5462.
- N. 20 ampere, 125/250 volt, 3 pole, 4 wire grounding, single phase receptacle shall be Hubbell catalog no. HBL8410.
- O. 20 ampere, 250 volt, 3 pole, 4 wire grounding, 3 phase single receptacle shall be Hubbell catalog no. HBL8420.
- P. Floor receptacles shall be Walker 500 AL series, G.E. Co. SP-400RG, or National no. 7903-LGC.
- Q. Clock outlets shall be Leviton catalog no. 5261-CH. Clock outlets to be mounted 6 inches to center below suspended ceiling or 7 feet above the floor in rooms without suspended ceiling.

2.3 COVER PLATES

- A. Switch and receptacle plates shall be stainless steel, non-magnetic type 302, such as Hubbell 97000 series, except where specified otherwise.
- B. Switch and receptacle plates in corrosion areas such as chemical laboratories shall be Leviton unbreakable nylon, color brown.
- C. Switch and receptacle plates shall be brown bakelite, such as Hubbell 91000 series, Leviton 84000 series, or approved equal.
- D. Weatherproof receptacle rain tight while in use covers shall be Hubbell WP826 series, Leviton 5970 or 5990 series, or equal Cooper or P. & S.

- E. Weatherproof switch plates shall be Hubbell catalog no. 1750 gray hypalon presswitch plate.
- F. Weatherproof switch plates shall be Hubbell catalog no. 1785 gray hypalon presswitch plate with 125V. red pilot light.

2.4 SPECIAL CONTROLS

- A. As specified, special controls shall be furnished by the contractor furnishing the associated equipment. These controls shall be connected by the electrical contractor.
- B. Refer to Mechanical Specifications.

2.5 TIME SWITCHES

- A. Connect time clock controlling supply, exhaust, and recirculating air fans as specified in the Mechanical Sections. Time clocks to be furnished by Mechanical Contractor.
- B. Time switches for window mounted air conditioners shall be Intermatic FF4H, SPST, 20A, 120V, brushed nickel dial with 4 hour timer. This 120V timer is used with a contactor having 120V control voltage for 120V and 208V air conditioners.
- C. Time switches to control individual room lights shall be Intermatic catalog no. T101, SPST, 125 volt, 40 amp., or approved equal.

2.6 RELAYS

- A. Multiple pole relays shall be Square D Class 8501, Type X, 600 volt, 10 ampere, or approved equal, Westinghouse, General Electric, Challenger, Cutler-Hammer, or Siemens number of poles and type of enclosure as noted on drawing.

PART 3 - EXECUTION

3.1 SWITCHES

- A. Switches, unless otherwise noted, shall be mounted 48 inches to center above finished floor.

3.2 RECEPTACLES

- A. Receptacle outlets, unless otherwise noted, shall be mounted 18 inches to center above finished floor.

END OF SECTION 262726

SECTION 265100 – INTERIOR LIGHTING

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. This Section specifies the interior light fixtures for buildings and structures.
 - 2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein.
 - 3. The Contractor shall furnish and install all light fixtures, as shown on the drawing. Light fixtures shall conform to the types and manufacturers as hereinafter specified.
 - 4. The Contractor shall furnish all lamps and necessary hangers, supports, wiring, etc., for installation of light fixtures.
- B. Related Sections include the following:
 - 1. Applicable sections of Division 26 – Electrical

It is the intent of MSU that all interior lighting installations will comply with the performance standard of LEED™ v3.0. The standard shall be implemented to the extent feasible and practicable in all new buildings and major renovation projects in existing buildings. Refer to LEED™ in Design Guidelines – General Section for more information.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Light fixtures

1.4 QUALITY ASSURANCE

- A. Light fixtures: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- B. Comply with NFPA 70, "National Electrical Code"

1.5 DESIGN REQUIREMENTS

- A. Light fixtures and lenses must comply with School Fire Safety Regulations adopted January 3, 1973. Certification shall accompany shop drawing submittal.

PART 2 - PRODUCTS

2.1 LENSES

- A. Lenses shall be flat, 0.125 inch thick, 100% virgin acrylic plastic, clear, with a prismatic pattern, and mounted in hinged metal frames.
- B. The following manufactures shall be considered as approved equal for the following luminaire types: Day-Brite, Lithonia, Metalux, Hubbell Columbia.
- C. Refer to Section 265113 Lighting Accessories for lamp and ballast specifications.

2.2 LIGHT FIXTURE SCHEDULE

LED Light Fixtures (refer to drawings)

Type LSM Surface mount, 0-10V dimming, light emitting diode fixture, 2 x 4 foot, shall be Lithonia catalog no. 2VTLX4-40L-ADP-EZ1-LP840, Philips 4124-D1-ST-L-8A-D-S-7-VOLT-E or approved equal. Higher lumen packages may be used for areas with high ceilings. This lighting fixture is intended for usage in classrooms, work rooms, offices, and similar areas with a plaster ceiling. Verify voltage to complete the part number.

Type LS1 Surface mount, white, 0.125 prismatic lens, 0-10V dimming, light emitting diode light fixture, 1 x 4 foot, shall be Lithonia catalog no. TLX-40L-FW-A12-EZ1-LP840 or approved equal. This lighting fixture is intended for usage in storage areas, work rooms, locker rooms, and similar areas with a plaster ceiling.

Type LS2 Surface mount, white, 0.125 prismatic lens, 0-10V dimming, light emitting diode light fixture, 2 x 4 foot, shall be Lithonia catalog no. 2TLX-40L-FW-A12-EZ1-LP840 or approved equal. This lighting fixture is intended for usage in storage areas, work rooms, locker rooms, and similar areas with a plaster ceiling.

Type CL Surface mounting, white, LED, 575 lumens, 4000K, 120V. Light fixture shall be Lithonia FMMCL-840. This lighting fixture is intended for usage in closets located in classroom, labs, open offices, and similar areas.

PART 3 - EXECUTION

- 3.1 Framing members of suspended ceiling systems used to support light fixtures shall be securely fastened to each other and shall be securely attached to the building structure at appropriate intervals.
- 3.2 Light fixtures so supported shall be securely fastened to the ceiling framing member by clips identified for use with the type of ceiling framing member and fixture. Bolts, screws, or rivets are not acceptable.
- 3.3 Light fixtures shall be served from a junction box, they shall not be daisy chained together. Light fixtures that share the same ballast may be tandem wired.

END OF SECTION 265100

SECTION 265200 - EMERGENCY LIGHTING

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. This Section specifies the emergency lighting fixtures for buildings and structures.
 - 2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein.
 - 3. The Contractor shall furnish and install all fixtures, as shown on the drawing. Fixtures shall conform to the types and manufacturers as hereinafter specified.
 - 4. The Contractor shall furnish all lamps and necessary hangers, supports, wiring, etc., for installation of fixtures.
- B. Related Sections include the following:
 - 1. Division 26 Section "Interior Lighting" for luminaires that have an emergency lighting function that are not specified in this section.
 - 2. Applicable sections of Division 26 - Electrical

1.3 DEFINITIONS

- A. CRI: Color-rendering index.
- B. HID: High-intensity discharge.
- C. LED: Light emitting diode
- D. Luminaire: Complete lighting fixture, including ballast housing if provided.
- E. Pole: Luminaire support structure, including tower used for large area illumination.
- F. Standard: Same definition as "Pole" above.

1.4 SUBMITTALS

- A. Shop Drawings: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, for the following:
 - 1. Emergency lighting units and fixtures
 - 2. EXIT lights
 - 3. Fire escape signs
- B. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70, “National Electrical Code”

PART 2 - PRODUCTS

2.1 EXIT LIGHTS

- A. Exit lights shall be type of mounting as indicated on drawing and shall be cast aluminum, black housing, with brushed aluminum face with 6 inch letters, green LED panel for multi-voltage. They shall be the Sure-Lites CX6G series, Lithonia LESG “Tru-Green” series, or Lightolier LDS-N-G-ASD.
- B. Exit lights shall be type of mounting as indicated on drawing and shall be cast aluminum, black housing, with brushed aluminum face with 6 inch letters, green LED panel for multi-voltage. They shall be the Sure-Lites CX7G series or Lithonia LESG ELN “Tru-Green” series, Lightolier LDS-A-G-ASD or Evenlite CHY-AB-CN.

2.2 EMERGENCY LIGHTING UNITS

- A. Contractor shall furnish and install battery operated emergency lighting units as shown on the drawing and hereinafter specified.
- B. Units shall conform to the Underwriters Laboratory standards and all provisions of the National Code.
- C. 4.8 Volt units to operate a maximum of 2 lamps mounted on unit shall be Sure-Lites Model SEL-M-60-R4-SD.

- D. 6 Volt Units to operate 2 to 7 lamps, 2 on unit, and 3 to 5 remote, shall be Exide model F-100.
- E. Batteries shall be maintenance free lead-calcium capable to full charge within 12 hours and to operate all lamps for 1 1/2 hours of light to and end voltage of 87 1/2 percent.
- F. Units shall be provided with solid state automatic charger and switching circuit, automatic overload protection, low voltage disconnect device, automatic brown-out feature, high charge-ready indicator light and push to test switch.
- G. Units shall have a self-diagnostic feature.
- H. Lamps for 6 Volt units with maximum 2 lamps, shall be Sure-lites model 6T6, tungsten halogen par 36, 6 Watt sealed beam.
- I. Lamps for 6 Volt units with 4 to 7 lamps, shall be Exide model H126, 12 Watt halogen.
- J. Contractor shall furnish and install remote mounted lamp assemblies as shown on drawing.
- K. Remote lamps shall be furnished with a flush mounting single gang stainless steel plate.

PART 3 - EXECUTION

3.1 EMERGENCY LIGHTING UNITS

- A. Units shall be mounted so that they may easily be removed for service. Wall shelves or brackets shall be designed in such a way that battery units are securely fastened to the mounting unit.
- B. Units shall be permanently connected to a 120 Volt AC, 60 cycle, single phase source, in compliance with the National Electric Code. A short piece of sealtite may be used where conduit enters unit.
- C. Remote lamps shall be connected to battery unit using wireway and wire size as shown on the drawing. Fixture shall be installed over flush mounted outlet box.
- D. Patch and return to original condition any areas cut to facilitate installation of any equipment.

END OF SECTION 265200

SECTION 280800 – COMMISSIONING OF FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the commissioning process for the fire alarm systems for buildings and structures.
- B. Related Sections:
 - 1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.
- C. Start-up of equipment and systems for the fire alarm systems, shall be done by or with a trained manufacturer's representative who can check and report on all items such as installation, operation, and see that the equipment or system starts and operates properly.
- D. Testing shall be performed at the convenience of the Owner and with the Owner's representatives present and the manufacturer's representative of the equipment and/or system present.

1.3 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.
- C. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 ALLOWANCES

- A. Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing are covered by the "Schedule of Allowances" Article in Division 01 Section "Allowances."

1.5 UNIT PRICES

- A. Commissioning testing allowance may be adjusted up or down by the "List of Unit Prices" Article in Division 01 Section "Unit Prices" when actual man-hours are computed at the end of commissioning testing.

1.6 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA.
- B. Attend construction phase controls coordination meeting.
- C. Attend testing, adjusting, and balancing review and coordination meeting.
- D. Participate in fire alarm systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. Provide information requested by the CxA for final commissioning documentation.
- F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.7 CxA'S RESPONSIBILITIES

- A. Provide Project-specific construction checklists and commissioning process test procedures for actual fire alarm systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Direct commissioning testing.
- C. Verify testing and adjusting of Work are complete.
- D. Provide test data, inspection reports, and certificates in Systems Manual

1.8 COMMISSIONING DOCUMENTATION

- A. Provide the following information to the CxA for inclusion in the commissioning plan:
 - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
 - 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
 - 3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for fire alarm systems, assemblies, equipment, and components to be verified and tested.
 - 4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.

5. Certificate of readiness certifying that fire alarm systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing and adjusting reports.

1.9 SUBMITTALS

- A. Certificates of readiness.
- B. Certificates of completion of installation, prestart, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

- A. Certify that fire alarm systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify that fire alarm instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify that testing and adjusting procedures have been completed and that testing and adjusting reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA

3.2 TESTING VERIFICATION

- A. Prior to performance of testing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

- B. Notify the CxA at least 10 days in advance of testing Work, and provide access for the CxA to witness testing Work.
- C. Provide technicians, instrumentation, and tools to verify testing of fire alarm systems at the direction of the CxA.
 - 1. The CxA will notify testing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
 - 2. The testing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
 - 3. Failure of an item includes, a deviation of more than 10 percent from an item's sensing set-point or output level, or an item's failure to function properly. Failure of an item shall result in rejection of final testing and adjusting report.
 - 4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of fire alarm testing shall include all components, equipment, and systems as outlined in outlined later in this section.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response to input signals.
- D. The CxA along with the Electrical Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the fire alarm system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests

3.4 FIRE ALARM SYSTEM

- A. Fire alarm and smoke detector systems shall be tested by operating each pull station and activating all system sensors to verify proper operation.
- B. Fire alarm notification devices, visual, audio, and transmitted signals, shall each be tested to verify proper operation.
- C. Any fire voice communications systems shall be tested to verify correct operation of all voice inputs and all speakers.

END OF SECTION 280800

SECTION 283100 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

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. This Section specifies the fire-alarm system for buildings and structures.
 - 2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein for a complete operating system.
 - 3. Provide a minimum of 16 hours of factory service engineer training on the operation of the manufacturer's fire-alarm system in general and on the system installed on this project.

1.3 DEFINITIONS

- A. FACP: Fire Alarm Control Panel
- B. FARCP: Fire Alarm Remote Control Panel
- C. NACP: Fire Alarm Notification Appliance Control Panel
- D. FAA: Fire Alarm Annunciator Panel
- E. FAIGA: Fire Alarm Interactive Graphic Annunciator
- F. FFCP: Fire Fighter Control Panel
- G. LED: Light-emitting diode
- H. NICET: National Institute for Certification in Engineering Technologies
- I. Definitions in NFPA 72 apply to fire-alarm terms used in this Section

1.4 SYSTEM DESCRIPTION AND PERFORMANCE REQUIREMENTS

If the lighting panel serving the fire-alarm control panel is in a different room, install a fire-alarm disconnect switch next to the fire-alarm control panel. In general fire-alarm control panels and graphic annunciators for new buildings shall be located in the main lobby or where the fire trucks will most likely respond; verify with Department of Police and Public Safety. Depending on application, (classification of building), select paragraph A.1 for academic, business, or non-dormitory facilities, or paragraph A.2 for dormitory facilities. Thermal detectors should be used in main electrical and mechanical rooms in lieu of smoke detectors (item to be reviewed with MSU staff).

- A. Fire-alarm system shall be a multiplexed point addressable type, non-coded, 24VDC, electrically supervised, U.L. approved, dedicated to fire-alarm service only.
 - 1. Alarm circuits shall be Class B, Style 4 for signaling line circuits and Class B, Style Y for notification appliance circuits for all academic or business occupancies. Speakers and strobes shall be operable over a single ground. The system shall comply with NFPA 72.
 - 2. Alarm circuits shall be 4-wire Class A, Type Z looped back to the control panel for all dormitories. Speakers and strobes shall be operable over a single open or ground. The system shall comply with NFPA 72.
- B. Device locations and ratings indicated on Drawings are minimum requirements, established for general scope and coordination purposes. In addition to devices shown on drawings, provide additional and supplemental devices as required to meet the requirements of the authorities having jurisdiction (AHJ), the fire alarm manufacturer, and all applicable codes up until bids are due. Any deviations including material and labor shall be included in the final bid price.
- C. Fire-alarm vendor shall provide sound pressure level calculations demonstrating compliance with NFPA 72 and establish quantities and tap settings of audible devices. Contractor shall modify settings as required to achieve proper levels for field conditions.
 - 1. If sound level is not acceptable to Owner, the Contractor shall adjust tap settings or add additional devices as required to achieve proper levels for field conditions.
- D. A complete functional system meeting the requirements of this specification, applicable codes and AHJ requirements shall be provided.
- E. Fire-alarm evacuation signal initiation shall be by one or more of the following devices:
 - 1. Manual stations
 - 2. Smoke detectors
 - 3. Heat detectors
 - 4. Automatic sprinkler system water flow
 - 5. Fire extinguishing system operation
 - 6. Fire standpipe system

If there is more than one area smoke detector in a space they may be cross-zoned, verify sequence of operation with Department of Police and Public Safety and indicate on the drawings.

- F. Fire-alarm evacuation signal shall initiate the following actions:
 - 1. Alarm notification appliances shall operate continuously.
 - 2. Identify alarm at the FACP, FAIGA and FAA.
 - 3. Illuminate the respective LEDs on any modular bullet annunciators.
 - 4. Transmit an alarm signal to the remote alarm receiving station via contact closures.
 - 5. Release fire and smoke doors held open by magnetic door holders.
 - 6. Activate voice/alarm communication system.
 - 7. Switch heating, ventilating and air-conditioning equipment controls to fire-alarm mode.
 - 8. Close smoke dampers in air ducts of system serving zone where alarm was initiated.
 - 9. Record events in the system memory.

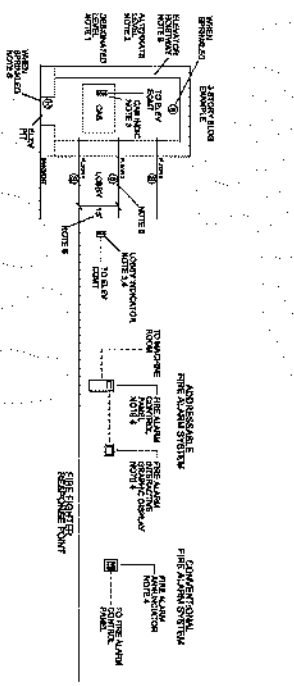
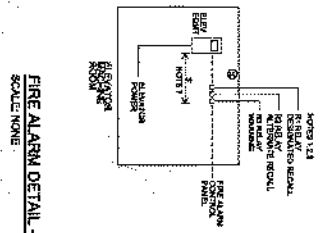
10. Record events by the system printer.
- G. Supervisory signal initiation shall be by one or more of the following devices or actions and will operate the trouble signal:
1. Operation of a fire-protection system or standpipe water flow switch.
 2. Low-air-pressure switch operation on a dry-pipe or pre-action sprinkler system.
 3. Operation of a valve tamper switch.
 4. Fire-pump power failure, including a dead-phase or phase-reversal condition.
 5. Fire-pump running.
- The MSU Pavilion for Agriculture is the only building on campus where the fire department will respond to a Supervisory condition. All other building require a general alarm condition.
- H. System trouble signal initiation shall be by one or more of the following devices or actions:
1. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
 2. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at the FACP.
 4. Ground or a single break in FACP internal circuits.
 5. Abnormal ac voltage at the FACP.
 6. A break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at the FACP, FAGA or FAA.
 9. Dirty smoke or heat detector.
- I. Provide connection to and capability of transmitting separate signals to the remote supervising station (MSU Police) via contact closure through security panel for the following:
1. Evacuation plan
 2. System trouble
 3. Sprinkler and/or standpipe water flow indication
 4. Sprinkler and/or standpipe water flow supervisory
 5. Duct smoke detectors
 6. Area smoke detectors (for spaces and smoke dampers)
 7. First smoke for smoke detectors cross zoned
- J. Transmit the following signals to the Central Campus DDC Siemens Apogee Energy Management System front end located in the IPF Building and port the 24 hour message through the Siemens Fire-alarm Supervising Station PC located in the Department of Police and Public Safety:
1. Evacuation alarm
 2. System trouble

- K. The fire alarm system shall seamlessly integrate with the existing National Time and Signal On-Point™ Central monitoring system providing the capability of remote notification to emergency responders and critical MSU staff members providing text and/or email messaging of the alarm location details.
1. Upon receipt of an alarm text or email message the emergency responder and/or MSU staff member shall be capable of remote access to On-Point™ Central for detailed building map viewing of the alarm point location identical to the map, which is displayed on the building's FAIGA.
 2. A minimum of one remote access user account shall be available to the responding fire department dispatch center for advanced building map viewing of the alarm event.
 3. The On-Point™ Central user interface shall store system events in one of four event queues represented by alarm, supervisory, trouble, or monitor.
- L. System Trouble and Supervisory Signal Actions: Sound trouble signal and annunciate at the FACP, FFCP, FAIGA, and FAA.
- M. There will be a "Trouble" silence switch located in the fire-alarm control panel and local annunciator that when operated will silence the audible "Trouble" devices while leaving the visual "Trouble" devices illuminated until the "Trouble" is corrected.
- N. Sprinkler water flow shall sound general evacuation alarm and will be annunciated in the fire-alarm annunciator panel and activate the audible trouble devices.
- O. The Fire Alarm System Control Panel shall be capable of system device disabling providing:
1. Individual and/or group disabling including but not limited to area smoke detectors, duct smoke detectors, fire pump, water-flow, pull stations, tamper switches, strobes, speakers, and door holders (held open).
 2. A minimum of six front panel programmable disable switches with an associated LED indicating the state of the programmed disable function.
 3. The front panel programmable disable switches shall be:
 - a. Accompanied with an associated LED indicating the state of the switch.
 - b. Located behind a locked Fire Alarm System Control Panel providing clear visibility and direct access. Embedded software switches using a menu driven user interface does not meet the requirement of this specification.
 - c. Duplicated on the FAIGA in the Control Panel screen.
 - d. Programmed to provide a system trouble on activation of the switch.
 - e. Programmed disabled options approved by Owner.
- P. Smoke/Heat Detectors:
- 1.
 2. Initiation of one smoke or heat detector shall sound the general evacuation alarm and send a signal to FACP, FARCP, FAIGA, FAA, the building DDC, and the Campus Security System.

3. When area smoke detectors are cross zoned, initiation of one smoke detector in each zone shall be required to sound the general evacuation alarm and send a signal to FACP, FAIGA, FAA, the building DDC, and the Campus Security System.
 - a. Initiation of one smoke detector shall send a first smoke supervisory signal to the FACP, FARCP, FAIGA, FAA, Building DDC, Campus Security System, and sound local sounder base in room.
 4. In academic buildings, automatic magnetic door holders will release when any smoke detector adjacent to door(s) is activated. In dormitories, all automatic magnetic door holders shall release on any general evacuation alarm.
- Q. FARCP's and NACP's shall be applied and located as approved by the Owner and Engineer. Signaling and notification circuits originating from these panels shall only serve devices on the same floor that the panel resides. Exceptions to this shall only be by approval of the Owner.
- R. The use of an un-intelligent breakout enclosures housing circuits originating from other floors in lieu of an intelligent fire alarm control panel does not meet the requirement of this specification. Exceptions to this shall only be by approval of the Owner.
- S. Provide the elevator recall fire alarm equipment when required on campus. See diagram on next page,

ELEVATOR RECALL - FIRE ALARM MATRIX

| SYSTEM FUNCTION | SYSTEM CONTROLS | | FIRE ALARM ANNUNCIATOR | FIRE ALARM CONTROL PANEL | FIRE ALARM CONTROL UNIT | FIRE ALARM CONTROL UNIT | FIRE ALARM CONTROL UNIT | FIRE ALARM CONTROL UNIT | FIRE ALARM CONTROL UNIT |
|---|-----------------|---|------------------------|--------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| | 1 | 2 | | | | | | | |
| 1. 1ST FLOOR LOBBY SMOKE DETECTOR | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 2. 2ND FLOOR LOBBY SMOKE DETECTOR | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 3. 3RD FLOOR LOBBY SMOKE DETECTOR | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 4. HOSTWAY SMOKE DETECTOR | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 5. WATERPROOF HEAT THERMOCOUPLE | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 6. ELEVATOR MACHINE ROOM SMOKE DETECTOR | ● | ● | ● | ● | ● | ● | ● | ● | ● |




ELECTRICAL SCOPE OF WORK:

1. ELEVATOR SUPPLIER
 1. PROVIDE EQUIPMENT WITH ELEVATOR CAB AND LOBBY VISUAL INDICATORS WITH THE ELEVATOR RECALL MESSAGES AND FLASHING FIRE FIGHTER HAT WARNING LIGHTS.
 2. PROVIDE COORDINATING BETWEEN FIRE ALARM RELAYS R1, R2 AND ELEVATOR EQUIPMENT.
 3. COORDINATE THE REQUIREMENTS OF THE SUPERVISION WITH THE FIRE ALARM RELAYS R1, R2.
2. ELECTRICAL CONTRACTOR OR MSU IPE ELECTRICIANS
 1. INSTALL ADDRESSABLE FIRE ALARM RELAY TO THE SMOKE DETECTOR LOCATIONS IN THE LOBBY, ELEVATOR MACHINE ROOM AND PROVIDE TERMINATION.
 2. INSTALL THE FIRE ALARM CABLING AND PROVIDE TERMINATION.
 3. INSTALL THE SMOKE DETECTOR AND CONNECT TO INITIATION LOOP.
 4. INSTALL ELEVATOR RECALL RELAYS R1-R2.
 5. HOSTWAY IS SPRINKLED.
 - 5.1. INSTALL SMOKE DETECTOR AT THE TOP OF THE SHAFT WITHIN 10' OF THE SPRINKLER HEAD.
 - 5.2. INSTALL SMOKE DETECTOR AT THE TOP OF THE SHAFT WITHIN 10' OF THE SPRINKLER HEAD.
 6. IF THE HOSTWAY IS NOT SPRINKLED.
 - 6.1. SMOKE DETECTION IS NOT REQUIRED AT THE TOP OF THE SHAFT.
 - 6.2. WATERPROOF HEAT THERMOCOUPLE MAY BE REQUIRED. VERIFY WITH MSU.
3. CONVENTIONAL FACP.
 1. PROVIDE AN EQUIVALENT SYSTEM WITH THE CONVENTIONAL FACP OR A SMALL ADDRESSABLE FACP DEDICATED FOR THE PURPOSE OF ELEVATOR RECALL MAY BE USED WITH THE CONVENTIONAL SYSTEM.
4. FIRE ALARM EQUIPMENT SUPPLIER.
 1. PROVIDE PROGRAMMING FOR NEW INITIATION DEVICES AND NOTIFICATION DEVICES.
 2. PROVIDE PROGRAMMING FOR NEW INITIATION DEVICES AND NOTIFICATION DEVICES.
 3. PROVIDE THE FOLLOWING VISUAL INDICATIONS FOR ELEVATOR RECALL.
 1. MODERN ADDRESSABLE FACP.
 1. FIRE ALARM CONTROL PANEL DIGITAL DISPLAY.
 2. INTERACTIVE GRAPHIC DISPLAY OR LED GRAPHIC ANNUNCIATOR.
 2. CONVENTIONAL FACP.
 1. LED GRAPHIC ANNUNCIATOR OR WINDOW ANNUNCIATOR.

SHEET NOTES:

1. R1 RELAY - ELEVATOR RECALL TO DESIGNATED FLOOR WILL OCCUR IF SMOKE IS DETECTED IN ANY LOBBY (EXCEPT AT DESIGNATED LEVEL) HOSTWAY, OR MACHINE ROOM.
2. R2 RELAY - ELEVATOR RECALL TO ALTERNATE FLOOR WILL OCCUR IF SMOKE IS DETECTED AT THE DESIGNATED FLOOR LOBBY.
3. R3 RELAY WARNING FOR THE PRESHORTER-DELAY LIGHT TO FLASH IN THE ELEVATOR CAB AND LOBBY IF SMOKE IS DETECTED IN THE ELEVATOR HOSTWAY OR MACHINE ROOM.
4. THE ELEVATOR LOBBY ANNUNCIATOR, THE FIRE ALARM PANEL, AND THE FIRE ALARM ANNUNCIATOR WILL PROVIDE VISUAL INDICATION OF A RECALL. THE INDICATION WILL READ "ELEVATOR IN RECALL".
5. THE LOBBY ELEVATOR SMOKE DETECTOR SHALL BE WITHIN 21' OF THE DOOR CENTERLINE.
6. FOR LOBBIES WITH CEILING HIGHER THAN 15' THE SMOKE DETECTOR SHALL BE INSTALLED WITHIN 60" OF THE TOP OF THE ELEVATOR DOOR.
7. THE ELEVATOR RECALL RELAYS SHALL BE LISTED, INSTALLED WITHIN 8' OF THE ELEVATOR EQUIPMENT, SUPERSEDED MONITORED FOR INTEGRITY, AND WILL INDICATE OPERATIONAL WIRING WITHIN 200 SEC. VERIFY REQUIREMENTS WITH LOCAL AHJ.
8. VERIFY MOUNTING LOCATION OF WATERPROOF HEAT THERMOCOUPLE WHEN RECALL WITH ELEVATOR SUPPLIER.
9. VERIFY WITH MSU FIRE PROTECTION IF A SMOKE EVACUATION SYSTEM IS REQUIRED.



1 of 1

FIRE ALARM ELEVATOR RECALL

MICHIGAN STATE UNIVERSITY Infrastructure Planning and Facilities

1.5 SUBMITTALS

A. General Submittal Requirements:

1. Refer to Division 01 – Specification Sections.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire-alarm Systems" Chapter in NFPA 72.
2. Shop drawings shall include:
 - a. Fire-alarm system description
 - b. Fire-alarm control panel (FACP) including layout of all modules
 - c. Fire-alarm graphic annunciator panel (FAIGA)
 - d. Fire-alarm remote control panel (FARCP)
 - e. Fire-alarm remote annunciator (FAA)
 - f. Fire-alarm initiation devices
 - g. Fire-alarm signal devices
 - h. Fire-alarm one-line diagram
 - i. Fire-alarm wiring details
 - j. Fire-alarm module drawings
3. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
4. Device Address List: Coordinate with final system programming. Allow for two corrections of device/system descriptions.
5. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
6. Include voltage drop calculations for notification appliance circuits.
7. Wiring diagram:
 - a. Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show the wiring color code.

- b. On all addressable systems, all devices on a loop shall be documented in a sequential order that the trunk enters and leaves them.
 - c. On all non-addressed device loops, all devices shall have numbers assigned to each device which is directly related to their wiring sequence.
 - d. Show all break-out boxes.
8. Batteries: Size calculations. Battery size shall be a minimum of 125% of the calculated requirement.
 9. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 10. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 11. Include documentation for smoke and heat detectors indicating compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 12. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.
 13. Voice/Alarm Signaling Service: Equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
 14. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
 15. Control Module: Provide calculations indicating circuit loading with 20% spare capacity.
- D. Qualification Data: For qualified Installer.
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Record copy of site-specific software.

4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
5. Manufacturer's required maintenance related to system warranty requirements.
6. Three complete sets of fire alarm system schematics, maintenance manuals of all system components and modules, and schematics of all modules and circuit boards. Include abbreviated operating instructions and 11" x 17" building drawings with device layout, junction boxes, and conduit runs for mounting in plastic folder inside FACP. Device addressing shall be included on the 11" x 17" building drawings for maintenance.
7. Three copies of the device list and certificate of completion.

G. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

H. As-Built Drawings

1. Contractor shall submit as-built drawings as specified in Division 1 - General Requirements.
2. The Contractor shall submit as-built drawings indicating the location of all devices, addresses, junction boxes, and conduit runs; including conduit size, circuiting and circuit numbers, and number of wires in each run; and the number and sequential wiring of speakers and strobes.. The drawings shall be separate from the electrical drawings. Provide "as-built" drawings in electronic media, CD, minimum AutoCAD 2004 format and Adobe Acrobat pdf format.

1.6 QUALITY ASSURANCE

A. Codes and Standards

1. Americans with Disabilities Act
2. National Electrical Code
3. National Fire Protection Agency
4. Underwriter's Laboratory

B. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

- C. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
- D. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
- G. Guarantee
 - 1. The Contractor shall provide a written guarantee stating that all work performed and material furnished is free from all defects in workmanship, and material for a period of two years after the equipment has been accepted by the Owner. Final payment or Certificate of Substantial Completion, whichever is issued first, shall constitute Owner acceptance.
 - 2. A 24 hour telephone number or numbers shall be provided for quick service engineering assistance concerning hardware and software problems. There shall be provisions made for getting an expert on the scene quickly should the need arise, minimum 8 hour on site response time.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 - 1. Notify Owner no fewer than two weeks in advance of proposed interruption of fire-alarm service.
 - 2. Do not proceed with interruption of fire-alarm service without the Owner's written permission.

1.8 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
- B. If any interruption of the existing or new fire alarm system is required the Contractor must provide a "fire watch" for that area of the building.
- C. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.9 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver materials to the IPF Electronics Shop through the Project Representative.
 - 1. Notification Appliances: Quantity equal to 10 percent of amount installed, but not less than 1 unit and not more than 5 of each type installed.
 - 2. Smoke, Thermal, and Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type and not more than 10 of each type installed.
 - 3. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type and not more than 5.
 - 4. Duct Detectors: Minimum of 2 of each type installed.
 - 5. Keys and Tools: All extra sets for access to locked and tamper proofed components.
 - 6. Fuses: Two of each type installed in the system.
 - 7. Spare controller module and monitor module, one of each type to be kept on hand at MSU IPF electronic shop for maintenance.
 - 8. Manual Stations: Quantity of two for each type installed.
 - 9. NAC's and PAD's: Quantity of two for each type installed.

1.11 PROJECT CONDITIONS

- A. Interruption of Existing Fire Alarm Service: Do not interrupt fire alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 - 1. Notify Owner no fewer than 10 days in advance of proposed interruption of fire alarm service.
 - 2. Do not proceed with interruption of fire alarm service without Owner's permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fire Alarm Control Panel and Equipment:
 - a. Siemens Building Technologies, Inc. XLS Series.

2.2 FIRE ALARM CONTROL PANEL (FACP)

A. General Description:

1. Modular, power-limited design with electronic modules, UL 864 listed.
2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at the FACP.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu:

1. Annunciator and Display: Liquid-crystal type, six inch, 640 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands; and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. FACP User Interface: System events shall be stored in one of four event queues represented by alarm, supervisory, trouble or monitor. The alarm event shall have priority over the supervisory, trouble, and monitor event queues with the ability to alternate between queues with a single button depression. On the activation of a system event the following sequence shall occur:

1. On Alarm: The FACP interface shall display the first alarm event with the ability to scroll to the subsequent alarm events via the Alarm Queue button. The FACP interface shall on alarm display the following:
 - a. The Alarm Queue Led flashes indicating an alarm status is present.
 - b. A custom message is displayed detailing location.

- c. The display shall indicate the number of active alarms present on the system.
 - d. The Alarm event status shall be identified as an active or restored event.
 - e. The Floor alarm zone LED is illuminated red indicating which floor(s) are in alarm.
 - f. The Floor Output LED is illuminated green indicating which floor(s) are sounding.
 - g. Alarm event acknowledge sequence shall execute as follows:
 - 1) The Alarm Queue button will sequentially step the operator through the alarm events, acknowledging the event on each Alarm Queue button depression. On the completion of acknowledging all alarm events, the Alarm Queue Led illuminates steady.
 - 2) A secondary means to view the alarm events shall be available via the up and down arrows. The Alarm Queue button shall return the display to the last acknowledged event.
 - 3) The FACP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
2. On Supervisory: The FACP interface shall display the first supervisory event with the ability to scroll to the subsequent supervisory events via the Supervisory Queue button. The FACP interface shall on supervisory display the following:
- a. The Supervisory Queue Led flashes indicating a Supervisory status is present.
 - b. A custom message is displayed detailing location.
 - c. The display shall indicate the number of active Supervisory(s) present on the system.
 - d. The Supervisory event status shall be identified as active or restored.
 - e. The Floor supervisory zone LED is illuminated amber indicating which floor(s) are in supervisory.
 - f. Supervisory event acknowledge sequence shall execute as follows:
 - 1) The Supervisory Queue button will sequentially step the operator through the supervisory events, acknowledging the event on each Supervisory Queue button depression. On the completion of acknowledging all supervisory events, the Supervisory Queue Led illuminates steady.
 - 2) A secondary means to view the supervisory events shall be available via the up and down arrows. The Supervisory Queue button shall return the display to the last acknowledged event.
 - 3) The FACP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
3. On Trouble: The FACP interface shall display the first Trouble event with the ability to scroll to the subsequent Trouble events via the Trouble Queue button. The FACP interface shall on Trouble display the following:
- a. The Trouble Queue Led flashes indicating a Trouble status is present.
 - b. A custom message is displayed detailing location.
 - c. The display shall indicate the number of active Troubles present on the system.
 - d. The Trouble event status shall be identified as active or restored event.

- e. The Floor alarm zone trouble LED flashes amber indicating which floor(s) are in trouble.
 - f. Trouble event acknowledge sequence shall execute as follows:
 - 1) The Trouble Queue button will sequentially step the operator through the trouble events, acknowledging the event on each Trouble Queue button depression. On the completion of acknowledging all trouble events, the Trouble Queue Led illuminates steady.
 - 2) A secondary means to view the trouble events shall be available via the up and down arrows. The Trouble Queue button shall return the display to the last acknowledged event.
 - 3) The FACP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
4. On Monitor: The FACP interface shall display the first Monitor event with the ability to scroll to the subsequent Monitor events via the Monitor Queue button. The FACP interface shall on Monitor display the following:
- a. The Monitor Queue Led flashes indicating a monitor status is present.
 - b. A custom message is displayed detailing location.
 - c. The display shall indicate the number of active Monitors present on the system.
 - d. The Monitor event status shall be identified as active or restored event.
 - e. Monitor event acknowledge sequence shall execute as follows:
 - 1) The Monitor Queue button will sequentially step the operator through the monitor events, acknowledging the event on each Monitor Queue button depression. On the completion of acknowledging all monitor events, the Monitor Queue Led illuminates steady.
 - 2) A secondary means to view the monitor events shall be available via the up and down arrows. The Monitor Queue button shall return the display to the last acknowledged event.
 - 3) The FACP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.

D. Circuits

- 1. Signaling Line Circuits: NFPA 72, Class B, Style 4.
 - a. System Layout: Install no more than 50 percent capacity addressable devices on each signaling line circuit (not to exceed 60 devices per loop maximum).
- 2. Notification-Appliance Circuits: NFPA 72, Class B, Style Y.
 - a. Audible/Speaker Circuit: No more than 50 percent capacity.
 - b. Visual Circuit: No more than 50 percent capacity.

3. Actuation of alarm notification appliances, emergency voice communications, annunciation, smoke control, and actuation of suppression systems shall occur within 10 seconds after the activation of an initiating device.
 4. Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown providing a break in the circuit will cause mechanical equipment to shut down.
- E. Notification-Appliance Circuit: Operation shall sound in a three pulse temporal pattern.
1. A pre-recorded digital voice message, complying with ANSI S3.41 shall be provided but not activated.
 2. Amplifier output voltage shall be 70 volts with speakers connected at 70 volts.
- F. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP after initiating devices are restored to normal.
1. Silencing-switch operation halts alarm operation of audible notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained. The visual notification appliances shall continue to operate.
 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- G. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
- H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and make a print-out of the final adjusted values on the system printer.
- I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble and water flow through auxiliary contacts connected to the existing security system panel and through existing central control building energy management panel.
- J. Voice/Alarm Signaling Service: A central emergency communication system with microphone, preamplifier, amplifier, and tone generator located in the FACP.
1. System shall be capable of indicating number of alarm channels for automatic, simultaneous transmission of different announcements to different zones, or for manual

transmission of announcements by use of the central-control microphone. Amplifiers shall be UL 1711 listed.

- a. Allow the application of and evacuation signal to indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection.
 - c. Standard digitally recorded messages for "Evacuation" and "All Clear".
 - d. Generate tones to be sequenced with audio messages of the type recommended by NFPA 72 and that are compatible with tone patterns of the notification-appliance circuits of the FACP.
2. Status Annunciator: Indicate the status of various voice/alarm speaker zones.
- K. Portable Printer: Ports shall be RS-232 for system printer.
1. Provide printer interface card for unsupervised interface with printer.
 2. Provide printer in nearest mechanical or communication room closest to FACP. This printer is provided on a project specific basis and is not required for all new installations.
- L. Printout of Events: On receipt of signal, when printer is installed, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble), and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including the same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- M. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory signal shall be powered by the 24-V dc source.
1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
- N. Secondary Power: Provide standby batteries with charger for operation of the system in the supervisory mode for up to 24 hours followed by a minimum of 5 minutes of an alarm condition in the event of power failure.
1. Batteries: Sealed lead calcium.
 2. Battery and Charger Capacity: Comply with NFPA 72.
- O. Surge Protection:
1. Install surge protection on normal ac power for the FACP and its accessories.

2. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.
- P. Provide Corbin catalog no. 15751 camlock and no. TEU-1 key.
- Q. Event History Log: Minimum 300 event history log of alarm, trouble and sprinkler supervisory alarm conditions and shall be complete with one-man system walk test.
- R. Provide FACP or remote panels sized to accommodate a minimum of two additional initiation, two speakers and four strobe circuits.
- S. Provide minimum of fourteen sets of normally open and normally closed auxiliary contacts (two for alarm, two for trouble, two for waterflow, two for first smoke, and six spare).

2.3 FIRE ALARM REMOTE CONTROL PANEL (FARCP)

- A. General Description:
 1. Modular, power-limited design with electronic modules, UL 864 listed.
 2. Addressable initiation devices that communicate device identity and status to the main FACP.
 3. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 1. Annunciator and Display: Liquid-crystal type, two line, 40 characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- C. FARCP User Interface: System events shall be stored in one of four event queues represented by alarm, supervisory, trouble or monitor. The alarm event shall have priority over the supervisory, trouble, and monitor event queues with the ability to alternate between queues with a single button depression. On the activation of a system event the following sequence shall occur:
 1. On Alarm: The FARCP interface shall display the first alarm event with the ability to scroll to the subsequent alarm events via the Alarm Queue button. The FACP interface shall on alarm display the following:
 - a. The Alarm Queue Led flashes indicating an alarm status is present.
 - b. A custom message is displayed detailing location.
 - c. The display shall indicate the number of active alarms present on the system.
 - d. The Alarm event status shall be identified as an active or restored event.

- e. The Floor alarm zone LED is illuminated red indicating which floor(s) are in alarm.
 - f. The Floor Output LED is illuminated green indicating which floor(s) are sounding.
 - g. Alarm event acknowledge sequence shall execute as follows:
 - 1) The Alarm Queue button will sequentially step the operator through the alarm events, acknowledging the event on each Alarm Queue button depression. On the completion of acknowledging all alarm events, the Alarm Queue Led illuminates steady.
 - 2) A secondary means to view the alarm events shall be available via the up and down arrows. The Alarm Queue button shall return the display to the last acknowledged event.
 - 3) The FARCP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
2. On Supervisory: The FARCP interface shall display the first supervisory event with the ability to scroll to the subsequent supervisory events via the Supervisory Queue button. The FARCP interface shall on supervisory display the following:
- a. The Supervisory Queue Led flashes indicating a Supervisory status is present.
 - b. A custom message is displayed detailing location.
 - c. The display shall indicate the number of active Supervisory(s) present on the system.
 - d. The Supervisory event status shall be identified as active or restored.
 - e. The Floor supervisory zone LED is illuminated amber indicating which floor(s) are in supervisory.
 - f. Supervisory event acknowledge sequence shall execute as follows:
 - 1) The Supervisory Queue button will sequentially step the operator through the supervisory events, acknowledging the event on each Supervisory Queue button depression. On the completion of acknowledging all supervisory events, the Supervisory Queue Led illuminates steady.
 - 2) A secondary means to view the supervisory events shall be available via the up and down arrows. The Supervisory Queue button shall return the display to the last acknowledged event.
 - 3) The FARCP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
3. On Trouble: The FARCP interface shall display the first Trouble event with the ability to scroll to the subsequent Trouble events via the Trouble Queue button. The FACP interface shall on Trouble display the following:
- a. The Trouble Queue Led flashes indicating a Trouble status is present.
 - b. A custom message is displayed detailing location.
 - c. The display shall indicate the number of active Troubles present on the system.
 - d. The Trouble event status shall be identified as active or restored event.
 - e. The Floor alarm zone trouble LED flashes amber indicating which floor(s) are in trouble.

- f. Trouble event acknowledge sequence shall execute as follows:
 - 1) The Trouble Queue button will sequentially step the operator through the trouble events, acknowledging the event on each Trouble Queue button depression. On the completion of acknowledging all trouble events, the Trouble Queue Led illuminates steady.
 - 2) A secondary means to view the trouble events shall be available via the up and down arrows. The Trouble Queue button shall return the display to the last acknowledged event.
 - 3) The FARCP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
 4. On Monitor: The FARCP interface shall display the first Monitor event with the ability to scroll to the subsequent Monitor events via the Monitor Queue button. The FACP interface shall on Monitor display the following:
 - a. The Monitor Queue Led flashes indicating a monitor status is present.
 - b. A custom message is displayed detailing location.
 - c. The display shall indicate the number of active Monitors present on the system.
 - d. The Monitor event status shall be identified as active or restored event.
 - e. Monitor event acknowledge sequence shall execute as follows:
 - 1) The Monitor Queue button will sequentially step the operator through the monitor events, acknowledging the event on each Monitor Queue button depression. On the completion of acknowledging all monitor events, the Monitor Queue Led illuminates steady.
 - 2) A secondary means to view the monitor events shall be available via the up and down arrows. The Monitor Queue button shall return the display to the last acknowledged event.
 - 3) The FACP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
- D. Circuits:
1. Signaling Line Circuits: NFPA 72, Class B, Style 4.
 - a. System Layout: Install no more than 50 percent capacity addressable devices on each signaling line circuit (not to exceed 60 devices per loop maximum).
 2. Notification-Appliance Circuits: NFPA 72, Class B, Style Y.
 - a. Audible/Speaker Circuit: No more than 50 percent capacity.
 - b. Visual Circuit: No more than 50 percent capacity.

3. Actuation of alarm notification appliances, emergency voice communications, annunciation, smoke control, and actuation of suppression systems shall occur within 10 seconds after the activation of an initiating device.
 4. Electrical monitoring for the integrity of wiring external to the FARCP for mechanical equipment shutdown providing a break in the circuit will cause mechanical equipment to shut down.
- E. Notification-Appliance Circuit: Operation shall sound in a three pulse temporal pattern.
1. A pre-recorded digital voice message, complying with ANSI S3.41 shall be provided but not activated.
 2. Amplifier output voltage shall be 70 volts with speakers connected at 70 volts.
- F. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.
- G. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
- H. Provide Corbin catalog no. 15751 camlock and no. TEU-1 key.
- 2.4 FIRE ALARM INTERACTIVE GRAPHIC DISPLAY (FAIGA)
- A. Manufacturers:
1. National Time and Signal Corporation, Model IGD-1042
- B. The FAIGA shall meet UL864.
- C. The fire alarm graphic annunciator shall be the National Time and Signal On-Point™ interactive graphical display enabled with the On-Point™ Fire Alarm Manager and Maintenance Manager.
- D. The Fire Alarm Manager shall store system events in one of four event queues represented by alarm, supervisory, trouble or monitor. The alarm event shall have priority over the supervisory, trouble, and monitor event queues with the ability to alternate between queues with a single button depression. On the activation of a system event the following sequence shall occur:
1. On Alarm: The FAIGA interface shall display:
 - a. The Graphical alarm screen providing on a single screen of view:
 - 1) Alarming device as it relates to the building's elevation and floor location.

- a) The alarming device on the floor shall illuminate red.
 - b) The alarming floor shall illuminate red
 - 2) The alarm building map shall color code the building rooms as follows:
 - a) Elevator and stairwells in a rose color
 - b) Residence rooms in a yellow color
 - c) Storage rooms in a brown color
 - d) Mechanical and electrical room in a lime color
 - e) Offices in a light blue color
 - f) Restrooms in a tan color
 - 3) The FAIGA shall display the Alarm Queue. The Alarm Queue event nomenclature shall identify:
 - a) Event type
 - b) Custom location message
 - c) Time and date of the alarm
 - d) Time and date of the restoral
 - 4) The alarm screen shall provide visible marking correlation between the selected alarming device icon located on the building map and the alarming device's queue event location.
 - 5) Display the Fire Pumps status indicating active or non-active state for phase reversal, power loss, and pump running.
 - 6) The alarm screen shall be capable of viewing the supervisory, trouble, and monitor screens with a single button depression with the capability of returning to the alarm screen on a single depression of the Alarm Queue button.
2. On Supervisory: The FAIGA interface shall display:
- a. The Graphical supervisory screen providing on a single screen of view:
 - 1) Active device as it relates to the building's elevation and floor location.
 - a) The active device on the floor shall illuminate amber.
 - b) The active floor shall illuminate amber
 - 2) The supervisory building map shall color code the building rooms as follows:
 - a) Elevator and stairwells in a rose color
 - b) Residence rooms in a yellow color
 - c) Storage rooms in a brown color
 - d) Mechanical and electrical room in a lime color
 - e) Offices in a light blue color
 - f) Restrooms in a tan color
 - 3) The FAIGA shall display the Supervisory Queue. The Supervisory Queue event nomenclature shall identify:
 - a) Event type
 - b) Custom location message
 - c) Time and date of the activation
 - d) Time and date of the restoral
 - 4) The supervisory screen shall provide visible marking correlation between the selected active device icon located on the building map and the active device's queue event location.

- 5) Display the Fire Pumps status indicating active or non-active state for phase reversal, power loss, and pump running.
 - 6) The supervisory screen shall be capable of viewing the alarm, trouble, and monitor screens with a single button depression with the capability of returning to the supervisory screen on a single depression of the Supervisory Queue button.
3. On Trouble: The FAIGA interface shall display:
- a. The Graphical trouble screen providing on a single screen of view:
 - 1) Active device as it relates to the building's elevation and floor location.
 - a) The active device on the floor shall illuminate amber.
 - b) The active floor shall illuminate amber
 - 2) The trouble building map shall color code the building rooms as follows:
 - a) Elevator and stairwells in a rose color
 - b) Residence rooms in a yellow color
 - c) Storage rooms in a brown color
 - d) Mechanical and electrical room in a lime color
 - e) Offices in a light blue color
 - f) Restrooms in a tan color
 - 3) The FAIGA shall display the Trouble Queue. The Trouble Queue event nomenclature shall identify:
 - a) Event type
 - b) Custom location message
 - c) Time and date of the activation
 - 4) The trouble screen shall provide visible marking correlation between the selected active device icon located on the building map and the active device's queue event location.
 - 5) Display the Fire Pumps status indicating active or non-active state for phase reversal, power loss, and pump running.
 - 6) The trouble screen shall be capable of viewing the alarm, supervisory, and monitor screens with a single button depression with the capability of returning to the trouble screen on a single depression of the Trouble Queue button.
4. On Monitor: The FAIGA interface shall display:
- a. The Graphical monitor screen providing on a single screen of view:
 - 1) Active device as it relates to the building's elevation and floor location.
 - a) The active device on the floor shall illuminate green.
 - b) The active floor shall illuminate green
 - 2) The monitor building map shall color code the building rooms as follows:
 - a) Elevator and stairwells in a rose color
 - b) Residence rooms in a yellow color
 - c) Storage rooms in a brown color
 - d) Mechanical and electrical room in a lime color
 - e) Offices in a light blue color
 - f) Restrooms in a tan color

- 3) The FAIGA shall display the Monitor Queue. The Monitor Queue event nomenclature shall identify:
 - a) Event type
 - b) Custom location message
 - c) Time and date of the activation
 - 4) The monitor screen shall provide visible marking correlation between the selected active device icon located on the building map and the active device's queue event location.
 - 5) Display the Fire Pumps status indicating active or non-active state for phase reversal, power loss, and pump running.
 - 6) The monitor screen shall be capable of viewing the alarm, supervisory, and trouble screens with a single button depression with the capability of returning to the monitor screen on a single depression of the Monitor Queue button.
- E. The Fire Alarm Manager software shall:
1. Annunciate 100 percent of all all initiating device points including but not limited to smoke detectors, heat detectors, pull stations, duct detectors, water flow, supervisory devices, fire pump status, etc.
 2. Identify hazardous material storage locations.
 3. Emergency equipment locator for but not limited to Fire Alarm Control Panel, fire extinguishers, fire hoses, shut off valves, fire elevators, stairwells, etc.
- F. The FAIGA shall use the building floor plans. Room names for rooms containing hazardous materials or that are secure shall only be visible during a fire alarm event or when in the maintenance mode.
- G. In the non-emergency mode the FAIGA shall display the following:
1. Alarm Queue
 2. Supervisory Queue
 3. Trouble Queue
 4. Monitor Queue
 5. Fire Pump status including pump running, phase reversal, and power loss.
- H. The FAIGA's Maintenance Manager Software provides an interactive touch-screen user display to make available facility fire alarm design installation information, active status conditions, and maintenance and service support functions. It shall provide:
1. Enable and Disable capability for input and output devices meeting UL864.
 2. Six custom programmable system device disabling switches capable of:
 - a. Individual and/or group disabling including but not limited to area smoke detectors, duct smoke detectors, fire pump, water-flow, pull stations, tamper switches, strobes, speakers, and door holders (held open).
 - b. Custom programmable disable switches shall have an associated indicator indicating the state of the programmed disable function.
 - c. The six custom programmable disable switches shall be replicated on the FACP.

- d. Programmed disabled options approved by Owner.
 3. Standard system output device disabling switches capable of:
 - a. Device type disable switches per floor or zone for:
 - 1) All floor/zone sounder bases
 - 2) All floor/zone Speakers
 - 3) All floor strobes
 - 4) All floor/zone door holders
 - 5) All floor/zone Damper and AHU control
 - b. Disable switches shall have an associated indicator indicating the state of the programmed disable function.
 4. Standard system input device disabling switches capable of:
 - a. Device type disable switches per floor or zone for:
 - 1) All floor/zone smoke detectors
 - 2) All floor/zone dorm room smoke detectors
 - 3) All floor/zone heat detectors
 - 4) All floor/zone duct detectors
 - 5) All floor/zone pull stations
 - 6) All floor/zone water flow
 - 7) All floor/zone tamper switches
 - b. Disable switches shall have an associated indicator indicating the state of the programmed disable function.
 5. The capability of device status query checking for trouble, alarm, and dirty detector, prior to re-enabling.
 6. Fire Alarm system as-built wire drawings shall be capable of illuminating active alarm, supervisory, trouble, and monitor device points.
 7. Fire Alarm riser diagram installation details capable of illuminating active alarm, supervisory, trouble, and monitor device points.
 8. Illumination of the active device points include but not limited to smoke detectors, heat detectors, pull stations, duct detectors, water flow devices, supervisory devices, fire pump status, control modules, NACP, etc..
 9. System events shall be stored in one of four event queues represented by alarm, supervisory, trouble or monitor. The alarm event shall have priority over the supervisory, trouble, and monitor event queues with the ability to alternate between queues with a single button depression.
- I. The FAIGA's user interface shall only display active features and /or functions consistent with this operational standard.
 - J. The FAIGA shall have a "YOU ARE HERE" arrow showing the location of the FAIGA in the building. Additional FAIGAs shall have the same map orientation with only the "YOU ARE HERE" location change to match relative locations for the additional FAIGAs
 - K. The FAIDG's software operating system shall be factory engineered by the fire alarm manufacturer. The FAIDG's software operating system software shall integrate emergency and non-emergency functionality seamlessly through one operator interface.
 - L. The non-emergency functionality includes but not limited to weather maps, directories, event messaging, way finding etc.

2.5 FIRE ALARM ANNUNCIATOR (FAA)

- A. General Description: Modular, power-limited design with electronic modules, UL 864 listed.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator and the Fire Alarm System including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 - 1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
 - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- C. FAA User Interface shall store system events in one of four event queues represented by alarm, supervisory, trouble or monitor. The alarm event shall have priority over the supervisory, trouble, and monitor event queues with the ability to alternate between queues with a single button depression. On the activation of a system event the following sequence shall occur:
 - 1. On Alarm: The FAA interface shall display the first alarm event with the ability to scroll to the subsequent alarm events via the Alarm Queue button. The FAA interface shall on alarm display the following:
 - a. The Alarm Queue Led flashes indicating an alarm status is present.
 - b. A custom message is displayed detailing location.
 - c. The display shall indicate the number of active alarms present on the system.
 - d. The Alarm event status shall be identified as an active or restored event.
 - e. Alarm event acknowledge sequence shall execute as follows:
 - 1) The Alarm Queue button will sequentially step the operator through the alarm events, acknowledging the event on each Alarm Queue button depression. On the completion of acknowledging all alarm events, the Alarm Queue Led illuminates steady.
 - 2) A secondary means to view the alarm events shall be available via the up and down arrows. The Alarm Queue button shall return the display to the last acknowledged event.
 - 3) The FACP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
 - 2. On Supervisory: The FAA interface shall display the first supervisory event with the ability to scroll to the subsequent supervisory events via the Supervisory Queue button. The FAA interface shall on supervisory display the following:
 - a. The Supervisory Queue Led flashes indicating a Supervisory status is present.
 - b. A custom message is displayed detailing location.
 - c. The display shall indicate the number of active Supervisory(s) present on the system.
 - d. The Supervisory event status shall be identified as active or restored.
 - e. Supervisory event acknowledge sequence shall execute as follows:

- 1) The Supervisory Queue button will sequentially step the operator through the supervisory events, acknowledging the event on each Supervisory Queue button depression. On the completion of acknowledging all supervisory events, the Supervisory Queue Led illuminates steady.
 - 2) A secondary means to view the supervisory events shall be available via the up and down arrows. The Supervisory Queue button shall return the display to the last acknowledged event.
 - 3) The FACP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
3. On Trouble: The FAA interface shall display the first Trouble event with the ability to scroll to the subsequent Trouble events via the Trouble Queue button. The FAA interface shall on Trouble display the following:
- a. The Trouble Queue Led flashes indicating a Trouble status is present.
 - b. A custom message is displayed detailing location.
 - c. The display shall indicate the number of active Troubles present on the system.
 - d. The Trouble event status shall be identified as active or restored event.
 - e. Trouble event acknowledge sequence shall execute as follows:
 - 1) The Trouble Queue button will sequentially step the operator through the trouble events, acknowledging the event on each Trouble Queue button depression. On the completion of acknowledging all trouble events, the Trouble Queue Led illuminates steady.
 - 2) A secondary means to view the trouble events shall be available via the up and down arrows. The Trouble Queue button shall return the display to the last acknowledged event.
 - 3) The FACP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.
4. On Monitor: The FAA interface shall display the first Monitor event with the ability to scroll to the subsequent Monitor events via the Monitor Queue button. The FAA interface shall on Monitor display the following:
- a. The Monitor Queue Led flashes indicating a monitor status is present.
 - b. A custom message is displayed detailing location.
 - c. The display shall indicate the number of active Monitors present on the system
 - d. The Monitor event status shall be identified as active or restored event.
 - e. Trouble event acknowledge sequence shall execute as follows:
 - 1) The Trouble Queue button will sequentially step the operator through the trouble events, acknowledging the event on each Trouble Queue button depression. On the completion of acknowledging all trouble events, the Trouble Queue Led illuminates steady.
 - 2) A secondary means to view the trouble events shall be available via the up and down arrows. The Trouble Queue button shall return the display to the last acknowledged event.

- 3) The FACP shall be capable of reset, alarm silence, and trouble silence by the Operator free of the need for 100 percent operator acknowledgement of prior events.

2.6 FIRE ALARM STATIONS

A. Manufacturers:

1. National Time and Signal Corporation, 541S.

B. Provide manufacturer recommended back box to accommodate pull stations and addressable modules.

C. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism with integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
2. Station Reset: Key or wrench operated switch.

D. Pull stations shall be mounted at 48" above finished floor.

2.7 SYSTEM SMOKE DETECTORS

A. Manufacturers:

1. National Time and Signal Corporation, D900-PHOTO.

B. General Description:

1. Operation of smoke detector heads shall sound evacuation alarm through all speakers and open contacts in duct detector for fan shut down circuits. Alarm and trouble condition shall also be indicated in annunciator panel. Each detector shall have a light to indicate activation and shall hold the signal of fire or smoke until manually reset.
2. Detectors shall lock in on alarm and shall have local or remote test and alarm/trouble capability.
3. Smoke detectors shall be analog-addressable with digital transmission of sensor values.
4. End of line power supervision module shall be compatible with the detectors.
5. UL 268 listed, operating at 24-V dc, nominal.
6. Smoke detectors shall communicate detector status (normal, alarm, or trouble) to the FACP.

7. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
8. Integral Visual-Indicating Light: Smoke detectors shall indicate detector status. When indicating light is not visible from the floor, a remote indicating light located in the ceiling or wall shall be installed.
9. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
 - a. Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg F (8 or 11 deg C) per minute.
 - b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F (57 or 68 deg C).
 - c. Provide multiple levels of detection sensitivity for each sensor.
10. Provide integral sounder base for smoke detector indicated when cross zoned.
11. Provide integral sounder base for smoke detectors located in student rooms in residence halls.

C. Photoelectric Smoke Detectors:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
3. Analog type with digital transmission of sensor values.

2.8 HEAT DETECTOR

- A. Actuated by either a fixed temperature of 135 rate-of-rise of temperature that exceeds 15 deg F per minute, unless otherwise indicated.
1. Mounting: Plug-in base, interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 3. Integral Visual-Indicating Light: Heat detectors shall indicate detector status.

2.9 NOTIFICATION APPLIANCES

- A. Manufacturers:

1. National Time and Signal Corporation, SG-CX Series Speaker Strobes and SG Series Strobes.
 - B. Description: Equipped for mounting as indicated and with screw terminals for system connections.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
 2. Color: Provide red for all wall mounted devices and white for all ceiling mounted devices.
 - C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 1. Rated Light Output: 15, 30, 75, 110 candela on the MC Series or 135/185 on the HMC Series as required to meet NFPA 72 requirements.
 2. Strobe Leads: Factory connected to screw terminals.
 3. Strobe Lights shall be synchronized so that all strobes flash simultaneously.
 - D. Voice/Tone Speakers:
 1. UL 1480 listed.
 2. Speakers shall be connected for 70 volt amplifier output.
 3. Low-Range Units: Rated 1 to 2 W.
 - a. Tap all speakers at 1 watt and 2 watts in mechanical rooms, unless otherwise indicated.
 4. Mounting: Flush, semi-recessed, or surface mounted; bidirectional as indicated.
 5. Matching Transformers: Tap range matched to the acoustical environment of the speaker location.
- 2.10 INTELLIGENT NOTIFICATION APPLIANCE CONTROL (NACP) PANELS
- A. NACP panels shall applied and located as approved by the Owner and Engineer.
 - B. Furnish separately mounted addressable remote intelligent Notification Appliance Control Panels (NACP) complete with battery standby.
 - C. Manufacturer's:
 1. National Time and Signal Corporation, D900-RPS-SG Series

- D. NACP panels shall connect to the *DigiComm*TM signaling line circuit and automatically report and display the following system fault conditions at the FACP, FFPCP, and the remote annunciators. Each NAC circuit fault shall be required to identify the location of the circuit by way of a unique 40-character message. In addition, the NACP panel shall identify the location of the NACP panel by way of a 40-character message. The NACP shall be capable of annunciating the following trouble conditions:
1. Processor Failure
 2. AC Power Failure
 3. Battery Fault
 4. Ground Fault
 5. Open Circuit for each NACP circuit
 6. Short Circuit for each NACP circuit
 7. Over current for each NACP circuit,
 8. Communication Fault
- E. Notification Appliance Circuit (NAC)
1. Each NAC shall be capable of delivering 2.5 amps at 24 Vdc nominal.
 2. Each NAC shall be capable of class A or B / style Y or Z operation.
- F. Auxiliary Power Supply
1. Each NACP panel shall be capable of delivering 0.5 amps at 24 Vdc nominal.
- G. Each NACP control panel shall have internal LED status indicators for individual fault conditions.
- H. Fire Alarm manufacturers not meeting the Intelligent NACP requirements shall be required to provide notification appliance circuits directly from a FARCP panel in lieu of an Intelligent NACP.

2.11 ADDRESSABLE CONTROL MODULE

- A. Provide for integration of auxiliary control functions into the analog signaling circuit. Intelligent analog signaling circuit control module shall have the following capabilities:
1. Communication interaction with the analog signaling circuit having the capability of initiating a control function to an auxiliary device based on a specified event.
 2. Provide NO/NC contact pairs rated at 4 amp 120 VAC or 24 VDC for fan shut down and smoke damper closure.

2.12 WIRE AND CABLE

- A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.
 - 1. All fire alarm cabling regardless of use must be stranded and installed in conduit.
 - 2. Shielded cable is only permitted for use from main FACP to remote FARCP and FAA. The shield on shielded cable shall be continuous throughout the circuit and insulated from ground and any other shielded cable except for the connection point at the panel.
 - 3. Shield cable shall also be used for the microphone circuit.
 - 4. Field devices shall be wired with non-shielded cable.
- B. Initiating Device or Signaling Line Circuits and Annunciator Communication Circuit
 - 1. Point addressable wiring shall be one pair of minimum #16 AWG THHN twisted pair stranded copper cable. Size of conductors shall be as recommended by manufacturer unless indicated otherwise on the drawings. If there is a conflict in conductor size, the larger conductor shall be installed if called for on the drawings or required by the manufacturer.
 - 2. Each initiating device circuit shall have a separate circuit number and labeled at every point the circuit is accessible.
- C. Notification Appliance Circuit
 - 1. Notification appliance circuits shall be one pair of minimum #14 AWG THHN twisted pair stranded copper cable. Size of conductors shall be as recommended by manufacturer unless indicated otherwise on the drawings. If there is a conflict in conductor size, the larger conductor shall be installed if called for on the drawings or required by the manufacturer.
 - 2. Notification appliance circuits shall be wired with different color, colors not already used in the fire alarm system, or circuits shall be numbered with wire markers on each end of each wire at every termination and joint. Wire markers shall be related to the fire alarm circuit or module connector numbers in the fire alarm control panel.
 - 3. Annunciator communication wiring shall be one pair of minimum size #18 AWG shielded twisted pair cable.
- D. Provide two minimum #14 AWG THHN stranded copper wire to devices requiring power such as door magnets and annunciator panel power. Circuits shall be numbered with wire markers on each end of each wire at every termination and joint. Wire markers shall be related to the fire alarm circuit or module connector numbers in the fire alarm control panel. Larger conductors sizes shall be used if required to serve the load.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Smoke or Heat Detector Spacing:

1. Smooth ceiling spacing shall not exceed the rating of the detector.
2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

B. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.

C. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.

D. Audible Alarm-Indicating Devices: Install per NFPA 72 and manufacturers recommendations.

E. Visible Alarm-Indicating Devices: Install per NFPA 72 and manufacturers recommendations.

F. FACP, FARCP and FAIGA: Surface or flush mount as indicated with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

1. Install smoke detector above all fire alarm panels and remote panels.

G. If NACP panels are approved by engineer and MSU, they must all be mounted in an organized and accessible location(s).

H. Any fire alarm device utilizing LED's for visual identification must be mounted so they can be viewed and read from the floor. If mounting cannot be viewed from the floor provide a remote indication device.

I. Provide an intelligent fire alarm control panel FARCP on each building floor for distributed operation. Each floor's intelligent fire alarm control panel shall provide:

1. Dedicated signaling line circuits originating from the floor's FARCP.
2. Dedicated notification appliance circuits originating from the floor's FARCP and/or intelligent NACP.
3. Alphanumeric Display and System Controls. System controls including but not limited to reset, alarm silence, and trouble silence.

J. The use of an un-intelligent breakout enclosures housing circuits originating from other floors in lieu of an intelligent fire alarm control panel does not meet the requirement of this specification.

3.2 WIRING INSTALLATION

- A. Install wiring according to the following:
 - 1. NECA 1.
 - 2. TIA/EIA 568-A.
- B. Wiring Method: Install wiring in metal raceway according to Division 16 Section "Raceways and Boxes".
 - 1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
 - 2. Install red fire alarm conduit in all concealed locations including above accessible ceilings, and exposed areas such as mechanical rooms, electrical, and loading docks.
 - 3. Install all fire alarm wiring/circuits entering or exiting junction/pull boxes with a minimum of six inches of slack at each end.
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, tie wrap, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

3.3 IDENTIFICATION

- A. All wiring shall be labeled where accessible in panels, at devices, junction boxes, pull boxes, etc. All smoke and heat detectors shall be permanently labeled with their respective address typewritten on the outside of the unit base. Marking shall be done with gummed paper tags installed on the surfaces that have been steel wool cleaned and typewritten addresses.
 - 1. Label all notification devices and visible alarm indicating devices with P-touch labeler. Identify circuit number, device number, and end of line.
 - 2. Provide a minimum of ¼ inch high text for all labeling requirements, unless otherwise indicated.

- B. Install instructions frame in a location visible from the FACP.
- C. Paint all fire alarm junction box covers red.

3.4 GROUNDING

- A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a minimum No. 10 AWG insulated ground wire from main service ground to all FACP.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
 - 1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
 - 2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
 - a. Include the existing system in tests and inspections.
 - 3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
 - 4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
 - 5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.6 SYSTEM COMPLIANCE

- A. Manufacturer to provide one year of *On-Point*[™] System Compliance connection to include:
 - 1. Reporting of fire alarm events via text and/or email messaging.
 - 2. Remote event viewing of active and historical events via secure browser interface.
 - 3. Remote factory diagnostic support.

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

3.8 DEMONSTRATION

- A. Training
 - 1. Provide a minimum of 16 hours of factory service engineer training on the operation of the manufacturer's fire alarm system in general and on the system installed.

END OF SECTION 283100