

January 4, 2019
Bids

Project Manual

**Ferndale Public Schools
Ferndale High School & Ferndale Middle School
Select Toilet Room Renovations
Ferndale, Michigan**

INTEGRATED design SOLUTIONS

architecture engineering interiors & technology

1441 w long lake road, suite 200
troy, michigan 48098

5211 cascade road se, suite 300
grand rapids, michigan 49546

248.823.2100, fax 248.823.2200
www.ids-troy.com

IDS Project No. 17226-4000

SECTION 00 0110 - TABLE OF CONTENTS

SECTION	TITLE	PAGES
PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP		
DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS		
INTRODUCTORY INFORMATION		
00 0101	Project Title Page	1 only
00 0110	Table of Contents	1 thru 3
PROCUREMENT REQUIREMENTS		
00 1113	Advertisement for Bids	1 thru 2
00 2100	Instructions to Bidders	1 thru 5
00 4100	Bid Form	1 thru 3
00 4500	Supplement to Bid Form – Familial Disclosure Statement	1 only
00 4510	Supplement to Bid Form – Affidavit of Compliance – Iran Economic Sanctions Act...	1 only
00 7000	Standard Abbreviated Form of Agreement Between Owner and Contractor AIA A104-2017	1 thru 20
00 7300	Supplementary Conditions and Additional Conditions	1 thru 5
SPECIFICATIONS GROUP		
GENERAL REQUIREMENTS SUBGROUP		
DIVISION 01 - GENERAL REQUIREMENTS		
01 1000	General Requirements, Substitution Request Form, Submittal Form	1 thru 24
FACILITY CONSTRUCTION SUBGROUP		
DIVISION 02 – EXISTING CONDITIONS		
02 4119	Selective Demolition	1 thru 4
DIVISION 03 – CONCRETE		
03 0130	Maintenance of Cast-In-Place Concrete	1 thru 2
DIVISION 04 - MASONRY		
04 2000	Unit Masonry Assemblies	1 thru 6
DIVISION 05 – METALS		
05 5000	Metal Fabrications	1 thru 4
DIVISION 06 – WOOD, PLASTICS AND COMPOSITES		
06 1000	Rough Carpentry	1 thru 4
DIVISION 07 - THERMAL AND MOISTURE PROTECTION		
07 5300	Single-Ply Membrane Roofing	1 thru 6
07 8413	Firestop Systems	1 thru 7
07 9200	Joint Sealants	1 thru 5

DIVISION 08 – OPENINGS

08 1113	Hollow Metal Doors and Frames	1 thru 5
08 3113	Access Doors	1 thru 3
08 8000	Glazing	1 thru 7

DIVISION 09 - FINISHES

09 2216	Non-Structural Metal Framing	1 thru 4
09 2900	Gypsum Board Assemblies	1 thru 5
09 3000	Tiling.....	1 thru 9
09 9100	Painting	1 thru 10

DIVISION 10 - SPECIALTIES

10 2113	Toilet Compartments	1 thru 4
10 2800	Toilet and Bath Accessories	1 thru 4

DIVISION 11 THRU DIVISION 14

Not Applicable

FACILITIES SERVICES SUBGROUP DIVISION 21 – FIRE SUPPRESSION

Not Applicable

DIVISION 22 – PLUMBING

22 0500	Common Work Results for Mechanical	1 thru 10
22 0510	Basic Mechanical Materials and Methods	1 thru 13
22 0519	Meters and Gages for Piping	1 thru 4
22 0523	Valves.....	1 thru 10
22 0529	Hangers and Supports for Mechanical	1 thru 5
22 0553	Mechanical Identification	1 thru 4
22 0719	Pipe Insulation.....	1 thru 9
22 1101	Hydronic Piping and Specialties	1 thru 8
22 1116	Domestic Water Piping	1 thru 6
22 1316	Sanitary Waste and Vent Piping	1 thru 7
22 4000	Plumbing Fixtures.....	1 thru 9
22 4100	Plumbing Specialties	1 thru 6

DIVISION 23 – HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)

23 0593	Testing, Adjusting and Balancing for HVAC	1 thru 8
23 0713	Duct Insulation.....	1 thru 7
23 0900	HVAC Instrumentation and Controls	1 thru 5
23 3113	Metal Ducts	1 thru 7
23 3300	Air Duct Accessories	1 thru 7
23 3423	HVAC Power Ventilators	1 thru 5
23 3713	Diffusers, Registers and Grilles	1 thru 2
23 8316	Radiant Heating Panels.....	1 thru 3

**FACILITIES SERVICES SUBGROUP
DIVISION 26 - ELECTRICAL**

26 0500	Common Work Results for Electrical.....	1 thru 11
26 0519	Low-Voltage Electrical Power Conductors and Cables (0-600V).....	1 thru 5
26 0526	Grounding and Bonding for Electrical Systems.....	1 thru 2
26 0529	Supporting Devices	1 thru 2
26 0533	Raceways and Boxes for Electrical Systems.....	1 thru 7
26 0553	Identification for Electrical Systems.....	1 thru 5
26 0570	Electrical Testing.....	1 thru 3
26 0923	Lighting Control Devices.....	1 thru 6
26 2413	Panelboards	1 thru 2
26 2726	Wiring Devices	1 thru 4
26 2913	Enclosed Controllers	1 thru 4
26 5119	LED Interior Lighting.....	1 thru 7

DIVISION 27 - COMMUNICATIONS

Not Applicable

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 3111	Fire Alarm System – Addressable	1 thru 4
---------	---------------------------------------	----------

**SITE AND INFRASTRUCTURE SUBGROUP
DIVISION 31 THRU DIVISION 33**

Not Applicable

**PROCESS EQUIPMENT SUBGROUP
DIVISION 40 – PROCESS INTEGRATION**

Not Applicable

END OF TABLE OF CONTENTS

SECTION 00 1113 - ADVERTISEMENT FOR BIDS

DATE: January 4, 2019

PROJECT: Ferndale Public Schools
Ferndale High School and Middle School
Select Toilet Room Renovations
Ferndale, Michigan

OWNER: Ferndale Public Schools
Central Offices
Ferndale High School, 3rd Floor, Room 326
871 Pinecrest
Ferndale, Michigan 48220

ARCHITECT: Integrated Design Solutions, LLC
Architecture, Engineering, Interiors & Technology

1441 W. Long Lake Road, Suite 200
Troy, MI 48098
5211 Cascade Road, SE, Suite 300
Grand Rapids, Michigan 49546

(248) 823-2100
(248) 823-2200 fax
www.ids-troy.com

BIDS RECEIVED: Until **1:00pm** local time on **February 1, 2019** the Owner will receive sealed Bids for the work as set forth in the Bidding Documents at:

Ferndale Public Schools Central Offices
Ferndale High School, 3rd Floor
871 Pinecrest
Ferndale, Michigan 48220

Attention: Nancy Hoover, Assistant Superintendent of Business Services

At 1:15 pm on said date, all Bids will be publicly opened and read aloud. The location of the public opening will be the Front Office Conference Room in the High School. A bid tabulation summary will be available.

Project Web Site: Project Web sites will be used for purposes of managing communication and documents during the bidding and construction stage.

The Bidding documents, are available at the following web site

Michigan Statewide Integrated Governmental Management Applications system (SIGMA):
<https://milogintp.michigan.gov/eai/tplogin>

The Bidding documents are also available at the following web site
<http://cloud.ids-troy.com/bids/bids/ferndale/Select-Toilet-Room-Renovations-2019/>

A pre-bid conference is scheduled for **January 18, 2018** at **11:00 am** local time. All Bidders are encouraged to attend. Bidders shall meet at Ferndale High School, 881 Pinecrest, Ferndale, Michigan 482220.

Each Bid shall be accompanied by a Bid Security in the form of a certified check, cashier's check, money order or bid bond made payable to Ferndale Public Schools in an amount not less than five percent (5%) of the base bid as a Bid guarantee.

Each bid shall be accompanied by the Familial Disclosure Statement in compliance with MCL.380.1267. The bid proposal must be accompanied by a sworn and notarized statement disclosing Familial Relationship that exists between the bidder or any employee of the bidder and any member of the Board of Education of the School district, or the Superintendent of the School district. The School district will not consider a Bid Proposal that does not include this sworn and notarized Disclosure Statement.

Each bid shall be accompanied by the Affidavit of Compliance – Iran Economic Sanctions Act in compliance with Michigan Public Act No. 517 of 2012. The School district will not consider a Bid Proposal that does not include this sworn and notarized Statement.

For Bids less than \$50,000 each bidder shall include in the Base Bid the cost of a Performance Bond and a Labor and Material Payment Bond, covering the faithful performance of the Contract and payment of all obligations arising there under, each in the amount of one hundred percent (100%) of the contract amount. Bonds shall be provided by a company licensed to do business in the State of Michigan.

For Bids over \$50,000, each Bidder shall indicate, in the space provided in the Bid Form, the cost of a Performance Bond and a Labor and Material Payment Bond covering the faithful performance of the Contract and payment of all obligations arising there under, each in the amount of one hundred percent (100%) of the contract amount. Should the Owner elect to require bonds, the cost shall be reimbursed by change order to the Contractor by the Owner

The bid security of Bidders under consideration will be returned immediately after execution of the Contract by the Owner. The amount of the bid security shall be forfeited to the Owner if the successful Bidder fails to enter into a contract and furnish required bonds and insurance certificates within ten (10) days after award of Contract.

Withdrawal of any Bid is prohibited for a period of sixty (60) days after the actual date of the opening thereof.

Each Bidder agrees to waive any claim it has or may have with the Owner, the Architect and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any bid.

The Owner reserves the right to reject any or all Bids, either in whole or in part, to reject a Bid not accompanied by the required bid security or by other data required by the Bidding Documents or to reject a Bid which is any way incomplete or irregular and to waive informality and irregularity in the bids and in the bidding.

The Owner reserves the right to accept Alternates in any order or combination and to determine the low Bidder on the basis of the sum of the base bid and the Alternates accepted.

The Owner reserves the right to negotiate with any Bidder without rebidding the project in whole or in part.

The Owner reserves the right to award the Contract to whomever it may elect.

END OF ADVERTISEMENT FOR BIDS

SECTION 00 2100 - INSTRUCTIONS TO BIDDERS

1. DEFINITIONS

- A. Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement for Bids, Instruction to Bidders, the Bid Form and other bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between Owner and Contractor, General Conditions of the Contract for Construction, Supplementary and other Conditions, Specifications, Drawings and Addenda issued prior to execution of the Contract.
- B. Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract, which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.
- C. A Bidder is a person or entity who submits a Bid.
- D. A Bid is a complete and properly signed proposal to do the work for the sums stipulated there in submitted in accordance with the Bidding Documents.
- E. The Base Bid is the amount stated in the Bid for which the Bidder offers to perform the work as described in the Bidding Documents as the base, to which work may be added to or deleted from, for the amounts stated in the Alternates.
- F. An Alternate is an amount stated in the Bid Form to be added to or deducted from the amount of the Base Bid if the described Alternate is accepted.
- G. A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the work as described in the Bidding Documents.

2. SECURING BIDDING DOCUMENTS

- A. Copies of the Bidding Documents may be obtained from the Michigan Statewide Integrated Governmental Management Applications system (SIGMA) web site or from Integrated Design Solutions, web site, upon conditions set forth in the Advertisement for Bids.

3. PREPARATION AND SUBMISSION OF BIDS

- A. Bids shall be submitted on forms bound in the Project Manual of the Bidding Documents.
- B. All blanks on the Bid Form must be filled in by typewriter or by hand in ink.
- C. Amounts shall be expressed in both words and figures. In case of a discrepancy the amount stated in words shall govern.
- D. Alterations by erasure or interlineations must be initialed by the Bidder.
- E. All Alternates must be bid. If no change in the Base Bid is required, enter "No Change".

- F. Submit the Bid, along with the bid security and any other documents required to be submitted with the Bid, to the Owner, and deliver to the address given in the Advertisement for Bids on or before the day and hour set for receipt of the Bids.
1. Enclose each Bid in a sealed opaque envelope bearing the title of the Work **Ferndale High School and Ferndale Middle School Select Toilet Room Renovations, Ferndale, Michigan** the name of the Bidder, and the date and hour of the Bid opening, with the notation "SEALED BID ENCLOSED".
 2. Do not change the wording of the Bid Form, and do not add words to, or delete words from the Bid Form.
 3. Unauthorized conditions, limitations, or provisions attached to the Bid will be cause for rejection of the Bid.
 4. Submit only duplicate signed copies of the Bid.
 5. It is the sole responsibility of the Bidder to see that his bid is received on time.
 6. Telephonic, telegraphic, facsimile (fax), or e-mail Bids or telephonic, telegraphic, facsimile (fax) or e-mail modification of a Bid will not be considered.
 7. Bids received after the time fixed for receiving them will not be considered and will be returned to the Bidder unopened.
 8. Properly identified Bids received on time will be privately opened. The Owner reserves the right to keep all information concerning such bids confidential.
 9. Properly identified Bids received on time will be publicly opened and read aloud. A bid tabulation summary will be available.
- G. The Bidder in submitting a Bid represents that:
1. The Bidder has read and understands the Bidding Documents, including the Drawings, Specifications and other proposed Contract Documents.
 2. The Bid is made in compliance with the Bidding Documents.
 3. The Bidder has visited the site of the Work and become informed as to existing conditions and limitations under which the Work is to be performed and included in their Bid a sum to cover the cost necessary to perform the Work as set forth in the Bidding Documents. No allowance will be made to a Bidder because of a lack of such examination or knowledge.
 4. The Bid is based upon materials, equipment and systems required by the Bidding Documents without exception and without substitutions.

4. **FAMILIAL DISCLOSURE STATEMENT**

- A. Each Bid shall be accompanied by the Familial Disclosure Statement in compliance with MCL.380.1267. The Bid proposal must be accompanied by a sworn and notarized statement disclosing Familial Relationship that exists between the bidder or any employee of the bidder and any member of the Board of Education of the School district, or the Superintendent of the School district. The School district will not consider a Bid Proposal that does not include this sworn and notarized Disclosure Statement.

5. **IRAN ECONOMIC SANCTIONS ACT AFFIDAVIT OF COMPLIANCE**

- A. Each Bid shall be accompanied by the Iran Economic Sanctions Act Affidavit of Compliance in compliance with Michigan Public Act No. 517 of 2012. The Bid proposal must be accompanied by a sworn and notarized statement hereby certifies, represents and warrants that the Bidder (including its officers, directors and employees) is not an "Iran Linked Business" within the meaning of the Iran Economic Sanctions Act, Michigan Public Act No. 517 of 2012 (the "Act"), and that in the event Bidder is awarded a Contract as a result of the aforementioned Advertisement for Bids, the Bidder will not become an "Iran Linked Business" at any time during the course of performing under the Contract..

6. BID SECURITY AND BONDS

- A. Each bid shall be accompanied by a certified check, cashier's check, money order or bid bond made payable to **Ferndale Public Schools** in an amount not less than five percent (5%) of the Base Bid as a proposal guarantee. Bid Bond shall be provided by a company licensed to do business in the State of Michigan.
- B. For Bids less than \$50,000 each bidder shall include in the Base Bid the cost of a Performance Bond and a Labor and Material Payment Bond, covering the faithful performance of the Contract and payment of all obligations arising there under, each in the amount of one hundred percent (100%) of the contract amount. Bonds shall be provided by a company licensed to do business in the State of Michigan.
- C. For Bids over \$50,000, each Bidder shall indicate, in the space provided in the Bid Form, the cost of a Performance Bond and a Labor and Material Payment Bond covering the faithful performance of the Contract and payment of all obligations arising there under, each in the amount of one hundred percent (100%) of the contract amount. Should the Owner elect to require bonds, the cost shall be reimbursed by change order to the Contractor by the Owner.
- D. The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this paragraph.
- E. Should the Bidder refuse to enter into a Contract or fail to furnish such bonds, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty.
- F. The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either the Contract has been executed and bonds have been furnished or the specified time has elapsed so that the Bid may be withdrawn or all Bids have been rejected.

7. MODIFICATIONS AND WITHDRAWAL OF BIDS

- A. A Bidder may not modify, withdraw or cancel a Bid, for a period of sixty (60) days following the time and date designated for receipt of Bids, and by submitting a Bid each Bidder shall so agree.
- B. A Bidder may withdraw their Bid, either personally or by written request, at any time prior to the scheduled time for receipt of bids. A withdrawn Bid may be resubmitted up to the date and time designated for receipt of Bids.
- C. Prior to the time and date for receipt of Bids, a Bidder may modify a Bid by notice to the party receiving Bids, at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date and time stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be worded as not to reveal the amount of the original Bid.

8. CONSIDERATION OF BIDS

- A. The Owner reserves the right to reject any or all Bids submitted either in whole or part, to reject a bid not accompanied by the required Bid security or by other data required by the Bidding Documents or to reject a Bid which is any way incomplete or irregular and to waive informality and irregularity in the Bids and in the Bidding.
- B. The Owner reserves the right to accept alternates in any order or combination and to determine the low Bidder on the basis of the sum of the Base Bid and the alternates accepted.
- C. The Owner reserves the right to negotiate with any Bidder without rebidding the project in whole or in part.

- D. The Owner reserves the right to award the Contract to whomever it may elect.

9. EXECUTION OF AGREEMENT

- A. The successful Bidder will be required to execute AIA Standard Abbreviated Form of Agreement between Owner and Contractor, AIA Document A104-2017.
- B. The Bidder to whom the Contract is awarded shall, within five (5) calendar days after notice of award and receipt of Agreement forms from the Owner, sign and deliver required copies to the Owner.
- C. At or prior to delivery of the signed Agreement, the Bidder to whom the Contract is awarded shall deliver to the Owner those Certificates of Insurance required by the Owner.
- D. The Owner shall approve Bonds and Certificates of Insurance before the successful Bidder may proceed with the Work. Failure or refusal to provide Bonds or Certificates of Insurance in a form satisfactory to the Owner shall subject the successful Bidder to loss of time from the allowable construction period equal to the time of delay in furnishing the required material.

10. INTERPRETATION OF CONTRACT DOCUMENTS PRIOR TO BIDDING

- A. Bidders shall study and compare the Bidding Documents with each other, shall examine the site and local conditions and if in doubt as to the true meaning of any part of the Bidding Documents, or finds discrepancies, inconsistencies, ambiguities or errors in or omissions from any part of the Bidding Documents, the Bidder may submit to the Architect a written request for interpretation thereof not later than seven days before bids will be opened. The person submitting the request shall be responsible for its prompt delivery.
- B. Interpretation, connection or changes to the proposed Contract Documents will be made only by Addendum. Explanations, interpretations, corrections or changes of the Bidding Documents by any other method will not be binding.

11. ADDENDA

- A. Addenda will be transmitted to all who are known by the Architect to have received a complete set of Bidding Documents.
- B. Copies of Addenda will be made available for inspection wherever Bidding Documents are on file.
- C. Addenda will be issued no later than four (4) days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which postpones the date for receipt of Bids.
- D. Each Bidder shall ascertain prior to submitting his bid that he has received all Addenda issued and shall acknowledge their receipt on the Bid Form.

12. SUBSTITUTIONS

- A. No substitutions will be considered prior to receipt of Bids, unless a written request for approval has been received by the Architect at least ten (10) days prior to the date for receipt of Bids. Such request for substitutions shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, samples and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

- B. If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum.
- C. No substitutions will be considered after Contract award unless specifically provided for in the Contract Documents.

13. TAXES

- A. All Bids shall include all applicable taxes, including social security unemployment, and sales or use taxes, and any other taxes specifically levied on the work or on wages by local, city, state, or federal government, except real property taxes on the site. Bids shall also include all premiums, assessments, and other like payments, charges, and costs incidental to the work covered by the Bidding Documents.

14. PERMITS AND FEES

- A. No building permits (local or State) are required.

15. TIME OF COMPLETION

- A. The Bidder, if awarded the Contract, agrees to complete the Work on or before the Contract Completion Date stated in the Bid Form.

16. EQUAL OPPORTUNITY

- A. The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.
- B. The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf; state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

17. POST BID INFORMATION

- A. Bidders to whom Contract award is under consideration shall submit to the Architect, upon request a properly executed AIA Document A305, Contractor's Qualification Statement unless such a Statement has been submitted as a prerequisite to the issuance of Bidding Documents.
- A. The Bidder to whom award of Contract is under consideration shall, with 48 hours of notification, submit to the Architect, the following:
 - 1. A designation of the Work to be performed with the Bidder's own forces.
 - 2. Names of the proposed major subcontractors.
 - 3. Names of manufacturers and products for principal systems, equipment and items of work.

END OF SECTION 00 2100

Ferndale Public Schools
Ferndale High School and Ferndale Middle School
Select Toilet Room Renovations
Ferndale, Michigan

IDS Project No. 17226-4000

SECTION 00 4100 - BID FORM

OWNER: Ferndale Public Schools
Central Offices
Ferndale High School 3rd Floor, Room 326
871 Pinecrest Drive
Ferndale, Michigan

PROJECT: Ferndale Public Schools
Ferndale High School and Middle School
Select Toilet Room Renovations
Ferndale, Michigan

ARCHITECT: Integrated Design Solutions, LLC
Architecture, Engineering, Interiors & Technology

1441 W. Long Lake Road, Suite 200
Troy, Michigan 48098
5211 Cascade Road, SE Suite 300
Grand Rapids, Michigan 49546

(248) 823-2100
(248) 823-2200 fax

NAME OF BIDDER: _____

ADDRESS: _____

TELEPHONE: _____

FAX NO: _____

EMAIL: _____

BID

Pursuant to and in compliance with your Advertisement for Bids, Instructions to Bidders and other documents relating thereto, the undersigned proposes and agrees to furnish equipment, materials, and labor and perform all work necessary to complete the Contract for the **Ferndale High School and Ferndale Middle School Select Toilet Room Renovations Project** in accordance with the Drawings and Specifications prepared by Integrated Design Solutions, LLC and agrees to accept payment as herein provided.

BASE BID

Lump sum bid for all work specified and shown on the Drawings:

_____ Dollars (\$_____).

NOTE: The amount shall be shown in both words and figures. In case of a discrepancy, the amount shown in words shall govern.

TAXES

The Bidder shall include in his Bid and shall pay all applicable Federal, State and local taxes of whatever character and description.

BID SECURITY

Accompanying this Bid is a certified check, cashier's check, money order or bid bond (cross out those not applicable) made payable to **Ferndale Public Schools** in the amount of five percent (5%), of Base Bid, which shall be retained by the Owner as liquidated damages, if the undersigned fails to execute the contract within ten (10) days of award of the Contract.

PERFORMANCE BONDS AND LABOR AND MATERIAL PAYMENT BONDS

For Bids less than \$50,000 include in the Base Bid the cost of a Performance Bond and a Labor and Material Payment Bond, covering the faithful performance of the Contract and payment of all obligations arising there under, each in the amount of one hundred percent (100%) of the contract amount.

For Bids over \$50,000, indicate, in the space provided below, the cost of a Performance Bond and a Labor and Material Payment Bond covering the faithful performance of the Contract and payment of all obligations arising there under, each in the amount of one hundred percent (100%) of the contract amount. Should the Owner elect to require bonds, the cost shall be reimbursed by change order to the Contractor by the Owner.

Cost of Performance bond and Labor and Material Payment Bond (For Bids over \$50,000): _____
_____ Dollars (\$_____).

ADDENDA

The undersigned acknowledges the receipt of the following addenda:

Addendum No. _____	Dated _____	Addendum No. _____	Dated _____
Addendum No. _____	Dated _____	Addendum No. _____	Dated _____
Addendum No. _____	Dated _____	Addendum No. _____	Dated _____

TIME OF COMPLETION

The undersigned agrees to substantially complete the Project by **August 16, 2019**. Bidders may start work on site **June 17, 2019**.

WITHDRAWAL OF BIDS

The undersigned agrees that his Bid shall not be withdrawn for a period of sixty (60) days after the date set for receipt of Bids.

SIGNATURE AND LEGAL STATUS OF BIDDER

Signed and sealed this _____ day of _____, 20____.

(Individual, Partnership, Corporation)

State of Incorporation

Affix Corporate Seal

By:

(Authorized Signature of Bidder)

(Print or Type Name of Bidder)

Title

Business Address

NOTE: Please submit one original and one copy of this form and retain one copy for your file

END OF BID FORM

**SECTION 00 4500
FAMILIAL DISCLOSURE STATEMENT**

1. The undersigned, the Owner or Authorized Officer of _____ ("the Bidder"), pursuant to the familial disclosure requirement provided in the Advertisement for Bids and Instructions to Bidders, hereby represent and warrant, except as provided below, that no familial relationships exist between the Bidder or any employee of the Ferndale Public Schools and any member of the Board of Education of the School District or the Superintendent of the School District.
2. List any Familial Relationships:

BIDDER

(Individual, Partnership or Corp.)

By _____
(Authorized Signature of Bidder)

Its _____
(Title)

State of Michigan

County of _____

This instrument was acknowledged before me on the _____ day of _____, 20__ by

Notary Public, _____
County, Michigan

My commission expires _____

THIS FORM MUST ACCOMPANY THE BID.
FAILURE TO SUBMIT THIS FORM WITH THE BID WILL RESULT IN THE BID BEING DISQUALIFIED.

**SECTION 00 4510 – SUPPLEMENT TO BID FORM
AFFIDAVIT OF COMPLIANCE – IRAN ECONOMIC SANCTIONS ACT**

MICHIGAN PUBLIC ACT NO. 517 OF 2012

The undersigned, the owner or authorized officer of _____ (the "Bidder"), pursuant to the compliance certification requirement provided in the Ferndale Public Schools (the "School District") Advertisement for Bids, hereby certifies, represents and warrants that the Bidder (including its officers, directors and employees) is not an "Iran Linked Business" within the meaning of the Iran Economic Sanctions Act, Michigan Public Act No. 517 of 2012 (the "Act"), and that in the event Bidder is awarded a Contract as a result of the aforementioned Advertisement for Bids, the Bidder will not become an "Iran Linked Business" at any time during the course of performing under the Contract.

The Bidder further acknowledges that any person who is found to have submitted a false certification is responsible for a civil penalty of not more than \$250,000.00 or 2 times the amount of the Contract or proposed Contract for which the false certification was made, whichever is greater, the cost of the School District's investigation, and reasonable attorney fees, in addition to the fine. Moreover, any person who submitted a false certification shall be ineligible to bid on an Advertisement for Bids for three (3) years from the date that it is determined that the person has submitted the false certification.

BIDDER:

Name of Bidder

By: _____

Its: _____

STATE OF MICHIGAN

COUNTY OF _____

This instrument was acknowledged before me on the ____ day of _____, 20____, by _____.

, Notary Public

_____ County, Michigan

My Commission Expires: _____

Acting in the County of : _____

END OF SUPPLEMENT TO BID FORM 00 4510

AIA Document A104™ – 2017

Standard Abbreviated Form of Agreement Between Owner and Contractor

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

Ferndale Public Schools
871 Pinecrest Drive
Ferndale, MI 48220

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

17226-4000 Ferndale Public Schools
Ferndale Public Schools
Ferndale High School
IDS Project No. 17226-4000

The Architect:
(Name, legal status, address and other information)

Integrated Design Solutions, L.L.C.
1441 West Long Lake Road
Suite 200
Troy, MI 48098
Telephone Number: (248) 823-2100
Fax Number: (248) 823-2200

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Init.

TABLE OF ARTICLES

1	THE WORK OF THIS CONTRACT
2	DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
3	CONTRACT SUM
4	PAYMENT
5	DISPUTE RESOLUTION
6	ENUMERATION OF CONTRACT DOCUMENTS
7	GENERAL PROVISIONS
8	OWNER
9	CONTRACTOR
10	ARCHITECT
11	SUBCONTRACTORS
12	CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
13	CHANGES IN THE WORK
14	TIME
15	PAYMENTS AND COMPLETION
16	PROTECTION OF PERSONS AND PROPERTY
17	INSURANCE AND BONDS
18	CORRECTION OF WORK
19	MISCELLANEOUS PROVISIONS
20	TERMINATION OF THE CONTRACT
21	CLAIMS AND DISPUTES

EXHIBIT A DETERMINATION OF THE COST OF THE WORK

ARTICLE 1 THE WORK OF THIS CONTRACT

The Contractor shall execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 2.1 The date of commencement of the Work shall be:

(Check one of the following boxes.)

☐ The date of this Agreement.

Init.

- ☐ A date set forth in a notice to proceed issued by the Owner.
- ☐ Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 2.2 The Contract Time shall be measured from the date of commencement.

§ 2.3 Substantial Completion

§ 2.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check the appropriate box and complete the necessary information.)

- ☐ Not later than () calendar days from the date of commencement of the Work.
- ☐ By the following date:

§ 2.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 2.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 2.3, liquidated damages, if any, shall be assessed as set forth in Section 3.5.

§ 2.4 Extension of Time. The Contractor agrees that time is of the essence of this Contract. Any extensions of the Substantial Completion Date shall only be granted to the extent that the delay: (1) has not been caused by the Contractor (including labor disputes involving Contractor's personnel or Subcontractor's personnel and late or delayed deliveries of materials or equipment to Contractor or Subcontractor); (2) is of a duration of not less than three (3) days; (3) is not concurrent with any other delay; and (4) is an addition to any time contingency periods set forth in the critical path for completion of the Work. Delays caused by unusual or adverse weather conditions shall not be grounds for extensions of the Substantial Completion Date or claims for additional compensation.

ARTICLE 3 CONTRACT SUM

§ 3.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be one of the following:
(Check the appropriate box.)

- ☐ Stipulated Sum, in accordance with Section 3.2 below
- ☐ Cost of the Work plus the Contractor's Fee, in accordance with Section 3.3 below
- ☐ Cost of the Work plus the Contractor's Fee with a Guaranteed Maximum Price, in accordance with Section 3.4 below

(Based on the selection above, complete Section 3.2, 3.3 or 3.4 below.)

§ 3.2 The Stipulated Sum shall be (\$), subject to written authorized additions and deductions as provided in the Contract Documents.

Init.

§ 3.2.1 The Stipulated Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

§ 3.2.2 Unit prices, if any:
(Identify the item and state the unit price and the quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit (\$0.00)
------	-----------------------	-------------------------

§ 3.2.3 Allowances, if any, included in the stipulated sum:
(Identify each allowance.)

Item	Price
------	-------

§ 3.3 Contract Sum and Limitation of Damages. The Owner agrees to pay and the Contractor agrees to accept the sum set forth in the Contract Sum as full compensation for all labor, supervision, equipment, home office and field overhead, administrative and incidental expense required in executing all of the Work contemplated in this contract as set forth in the plans and specifications, including all loss or damage arising out of the Work, as impacted by the elements or from any obstruction, delay or difficulties which may be encountered. It is further agreed that the Work may be modified, in nature or scope and that the Contract Sum may likewise be modified only in accordance with the Contract Documents. No claims for extra compensation or adjustments in the Contract Sum will be made by or due to the Contractor on account of delay, costs incurred as a result of variations within the as-planned schedule, or the failure of others to complete any of the Work as scheduled. The Contractor agrees that its only remedy for delay shall be extension of time if justified under subparagraph 2.4 above

(Paragraphs deleted)

(Table deleted)

(Paragraphs deleted)

(Table deleted)

(Paragraphs deleted)

§ 3.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

ARTICLE 4 PAYMENT

§ 4.1 Progress Payments

§ 4.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 4.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 4.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall, after approval, make payment of the certified amount to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the date fixed above, payment shall be made by the Owner not later than () days after the Architect receives the Application for Payment.

(Federal, state or local laws may require payment within a certain period of time.)

Init.

§ 4.1.4 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold retainage from the payment otherwise due as follows:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment and any terms for reduction of retainage during the course of the Work. The amount of retainage may be limited by governing law.)

§ 4.1.5 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

%

§ 4.2 Final Payment

§ 4.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 18.2, and to satisfy other requirements, if any, which extend beyond final payment;
- .2 the Contractor has submitted a final accounting for the Cost of the Work, where payment is on the basis of the Cost of the Work with or without a Guaranteed Maximum Price; and
- .3 a final Certificate for Payment has been issued by the Architect in accordance with Section 15.7.1.

§ 4.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

ARTICLE 5 DISPUTE RESOLUTION

§ 5.1 Binding Dispute Resolution

For any claim subject to, but not resolved by, mediation pursuant to Section 21.1, the method of binding dispute resolution shall be as follows:

(Check the appropriate box.)

- ☐ Arbitration pursuant to Section 21.6 of this Agreement
- ☒ Litigation in a court of competent jurisdiction
- ☐ Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, claims will be resolved in a court of competent jurisdiction.

ARTICLE 6 ENUMERATION OF CONTRACT DOCUMENTS

§ 6.1 The Contract Documents are defined in Article 7 and, except for Modifications issued after execution of this Agreement, are enumerated in the sections below. Whenever any reference is made to "Standard Form" AIA documents, such references shall be read to include any amendments to the standard form approved in writing by the parties.

§ 6.1.1 The Agreement is this executed AIA Document A104™-2017, Standard Abbreviated Form of Agreement Between Owner and Contractor.

Init.

§ 6.1.2 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:

(Insert the date of the E203–2013 incorporated into this Agreement.)

§ 6.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
----------	-------	------	-------

§ 6.1.4 The Specifications:

(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

Section	Title	Date	Pages
---------	-------	------	-------

§ 6.1.5 The Drawings:

(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

Number	Title	Date
--------	-------	------

§ 6.1.6 The Addenda, if any:

Number	Date	Pages
--------	------	-------

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are enumerated in this Article 6.

§ 6.1.7 Additional documents, if any, forming part of the Contract Documents:

.1 Other Exhibits:

(Check all boxes that apply.)

☐ Exhibit A, Determination of the Cost of the Work.

☐ AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:

(Insert the date of the E204-2017 incorporated into this Agreement.)

☐ The Sustainability Plan:

Title	Date	Pages
-------	------	-------

☐ Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
----------	-------	------	-------

.2 Other documents, if any, listed below:

(List here any additional documents that are intended to form part of the Contract Documents.)

ARTICLE 7 GENERAL PROVISIONS

§ 7.1 The Contract Documents

The Contract Documents are enumerated in Article 6 and consist of this Agreement (including, if applicable, Supplementary and other Conditions of the Contract), Drawings, Specifications, Addenda issued prior to the execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 7.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind between any persons or entities other than the Owner and the Contractor.

§ 7.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 7.4 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 7.5 Ownership and use of Drawings, Specifications and Other Instruments of Service

§ 7.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 7.5.2 The Contractor, Subcontractors, Sub-subcontractors and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to the protocols established pursuant to Sections 7.6 and 7.7, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 7.6 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 7.7 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

§ 7.8 Severability

The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 7.9 Notice

§ 7.9.1 Except as otherwise provided in Section 7.9.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203–2013, insert requirements for delivering Notice in electronic format such as name, title and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 7.9.2 Notice of Claims shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 7.10 Relationship of the Parties

Where the Contract is based on the Cost of the Work plus the Contractor's Fee, with or without a Guaranteed Maximum Price, the Contractor accepts the relationship of trust and confidence established by this Agreement and covenants with the Owner to cooperate with the Architect and exercise the Contractor's skill and judgment in furthering the interests of the Owner; to furnish efficient business administration and supervision; to furnish at all times an adequate supply of workers and materials; and to perform the Work in an expeditious and economical manner consistent with the Owner's interests. The Owner agrees to furnish and approve, in a timely manner, information required by the Contractor and to make payments to the Contractor in accordance with the requirements of the Contract Documents.

ARTICLE 8 OWNER

§ 8.1 Information and Services Required of the Owner

§ 8.1.1 Prior to commencement of the Work, at the written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 8.1.1, the Contract Time shall be extended appropriately.

§ 8.1.2 The Owner shall furnish all necessary surveys and a legal description of the site.

§ 8.1.3 The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 8.1.4 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 9.6.1, the Owner shall secure and pay for other necessary approvals,

Init.

easements, assessments, and charges required for the construction, use, or occupancy of permanent structures or for permanent changes in existing facilities.

§ 8.2 Owner's Right to Stop the Work

If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents, or fails to carry out the Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order is eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

§ 8.3 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to any other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 15.4.3, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including the Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 21.

ARTICLE 9 CONTRACTOR

§ 9.1 Review of Contract Documents and Field Conditions by Contractor

§ 9.1.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 9.1.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 8.1.2, shall take field measurements of any existing conditions related to that portion of the Work and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies, or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents.

§ 9.1.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 9.2 Supervision and Construction Procedures

§ 9.2.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters.

§ 9.2.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for or on behalf of the Contractor or any of its Subcontractors.

§ 9.3 Labor and Materials

§ 9.3.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other

facilities and services necessary for proper execution and completion of the Work whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 9.3.2 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

§ 9.3.3 The Contractor may make a substitution only with the consent of the Owner, after evaluation by the Architect and in accordance with a Modification.

§ 9.4 Warranty

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation or normal wear and tear under normal usage. All other warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 15.6.3.

§ 9.5 Taxes

The Contractor shall pay sales, consumer, use, and other similar taxes that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 9.6 Permits, Fees, Notices, and Compliance with Laws

§ 9.6.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for any applicable permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 9.6.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work. If the Contractor performs Work contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 9.7 Allowances

The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. The Owner shall select materials and equipment under allowances with reasonable promptness. Allowance amounts shall include the costs to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts. Contractor's costs for unloading and handling at the site, labor, installation, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowance.

§ 9.8 Contractor's Construction Schedules

§ 9.8.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 9.8.2 The Contractor shall perform the Work in general accordance with the most recent schedule submitted to the Owner and Architect.

§ 9.9 Submittals

§ 9.9.1 The Contractor shall review for compliance with the Contract Documents and submit to the Architect Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents in coordination with the

Contractor's construction schedule and in such sequence as to allow the Architect reasonable time for review. By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them; (2) determined and verified materials, field measurements, and field construction criteria related thereto, or will do so; and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents. The Work shall be in accordance with approved submittals.

§ 9.9.2 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents.

§ 9.9.3 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents or unless the Contractor needs to provide such services in order to carry out the Contractor's own responsibilities. If professional design services or certifications by a design professional are specifically required, the Owner and the Architect will specify the performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional. If no criteria are specified, the design shall comply with applicable codes and ordinances. Each Party shall be entitled to rely upon the information provided by the other Party. The Architect will review and approve or take other appropriate action on submittals for the limited purpose of checking for conformance with information provided and the design concept expressed in the Contract Documents. The Architect's review of Shop Drawings, Product Data, Samples, and similar submittals shall be for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. In performing such review, the Architect will approve, or take other appropriate action upon, the Contractor's Shop Drawings, Product Data, Samples, and similar submittals.

§ 9.10 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 9.11 Cutting and Patching

The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. The Contractor shall be responsible for finishing the Work so that areas which required cutting, fitting, or patching match and blend in unnoticeable with the surrounding areas

§ 9.12 Cleaning Up

The Contractor shall keep the premises and surrounding area clean and free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus material from and about the Project.

§ 9.13 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 9.14 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 9.15 Indemnification

§ 9.15.1 To the fullest extent permitted by law, the Contractor shall indemnify, defend and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to

injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 9.15.1.

§ 9.15.2 In claims against any person or entity indemnified under this Section 9.15 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 9.15.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 10 ARCHITECT

§ 10.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction, until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with other provisions of the Contract.

§ 10.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 10.3 The Architect will visit the site at intervals appropriate to the stage of the construction to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general, if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 10.4 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 10.5 Based on the Architect's evaluations of the Work and of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 10.6 The Architect has authority to reject Work that does not conform to the Contract Documents and to require inspection or testing of the Work.

§ 10.7 The Architect will review and approve or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 10.8 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect will make initial decisions on all claims, disputes, and other matters in question between the Owner and Contractor but will not be liable for results of any interpretations or decisions rendered in good faith.

§ 10.9 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

ARTICLE 11 SUBCONTRACTORS

§ 11.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site.

§ 11.2 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the Subcontractors or suppliers proposed for each of the principal portions of the Work. The Contractor shall not contract with any Subcontractor or supplier to whom the Owner or Architect has made reasonable written objection within ten days after receipt of the Contractor's list of Subcontractors and suppliers. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 11.3 Contracts between the Contractor and Subcontractors shall (1) require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by the Contract Documents, assumes toward the Owner and Architect, and (2) allow the Subcontractor the benefit of all rights, remedies and redress against the Contractor that the Contractor, by these Contract Documents, has against the Owner.

ARTICLE 12 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 12.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 12.2 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's activities with theirs as required by the Contract Documents.

§ 12.3 The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a Separate Contractor because of delays, improperly timed activities, or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs incurred by the Contractor because of delays, improperly timed activities, damage to the Work, or defective construction of a Separate Contractor.

ARTICLE 13 CHANGES IN THE WORK

§ 13.1 By appropriate Modification, changes in the Work may be accomplished after execution of the Contract. The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, with the Contract Sum and Contract Time being adjusted accordingly. Such changes in the Work shall be authorized by written Change Order signed by the Owner, Contractor, and Architect, or by written Construction Change Directive signed by the Owner and Architect. Upon issuance of the Change Order or Construction Change Directive, the Contractor shall proceed promptly with such changes in the Work, unless otherwise provided in the Change Order or Construction Change Directive.

§ 13.2 Adjustments in the Contract Sum and Contract Time resulting from a change in the Work shall be determined by mutual agreement of the parties or, in the case of a Construction Change Directive signed only by the Owner and Architect, by the Contractor's cost of labor, material, equipment, and reasonable overhead and profit, unless the parties agree on another method for determining the cost or credit. Pending final determination of the total cost of a Construction Change Directive, the Contractor may request payment for Work completed pursuant to the Construction Change Directive. The Architect will make an interim determination of the amount of payment due for purposes of certifying the Contractor's monthly Application for Payment. When the Owner and Contractor agree on adjustments to the Contract Sum and Contract Time arising from a Construction Change Directive, the Architect will prepare a Change Order.

§ 13.3 The Architect will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work.

§ 13.4 If concealed or unknown physical conditions are encountered at the site that differ materially from those indicated in the Contract Documents or from those conditions ordinarily found to exist, the Contract Sum and Contract Time shall be equitably adjusted as mutually agreed between the Owner and Contractor; provided that the Contractor provides notice to the Owner and Architect promptly and before conditions are disturbed.

ARTICLE 14 TIME

§ 14.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing this Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 14.2 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 14.3 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 14.4 The date of Substantial Completion is the date certified by the Architect in accordance with Section 15.6.3.

§ 14.5 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) changes ordered in the Work; (2) by fire, unavoidable casualties, or any causes beyond the Contractor's control; or (3) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine, subject to the provisions of Article 21 and Section 2.4.

ARTICLE 15 PAYMENTS AND COMPLETION

§ 15.1 Schedule of Values

§ 15.1.1 Where the Contract is based on a Stipulated Sum or the Cost of the Work with a Guaranteed Maximum Price pursuant to Section 3.2 or 3.4, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Stipulated Sum or Guaranteed Maximum Price to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy required by the Architect. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 15.1.2 The allocation of the Stipulated Sum or Guaranteed Maximum Price under this Section 15.1 shall not constitute a separate stipulated sum or guaranteed maximum price for each individual line item in the schedule of values.

§ 15.2 Control Estimate

§ 15.2.1 Where the Contract Sum is the Cost of the Work, plus the Contractor's Fee without a Guaranteed Maximum Price pursuant to Section 3.3, the Contractor shall prepare and submit to the Owner a Control Estimate within 14 days of executing this Agreement. The Control Estimate shall include the estimated Cost of the Work plus the Contractor's Fee.

§ 15.2.2 The Control Estimate shall include:

- .1 the documents enumerated in Article 6, including all Modifications thereto;
- .2 a list of the assumptions made by the Contractor in the preparation of the Control Estimate to supplement the information provided by the Owner and contained in the Contract Documents;
- .3 a statement of the estimated Cost of the Work organized by trade categories or systems and the Contractor's Fee;
- .4 a project schedule upon which the Control Estimate is based, indicating proposed Subcontractors, activity sequences and durations, milestone dates for receipt and approval of pertinent information,

- schedule of shop drawings and samples, procurement and delivery of materials or equipment the Owner's occupancy requirements, and the date of Substantial Completion; and
- .5 a list of any contingency amounts included in the Control Estimate for further development of design and construction.

§ 15.2.3 When the Control Estimate is acceptable to the Owner and Architect, the Owner shall acknowledge it in writing. The Owner's acceptance of the Control Estimate does not imply that the Control Estimate constitutes a Guaranteed Maximum Price.

§ 15.2.4 The Contractor shall develop and implement a detailed system of cost control that will provide the Owner and Architect with timely information as to the anticipated total Cost of the Work. The cost control system shall compare the Control Estimate with the actual cost for activities in progress and estimates for uncompleted tasks and proposed changes. This information shall be reported to the Owner, in writing, no later than the Contractor's first Application for Payment and shall be revised and submitted with each Application for Payment.

§ 15.2.5 The Owner shall authorize preparation of revisions to the Contract Documents that incorporate the agreed-upon assumptions contained in the Control Estimate. The Owner shall promptly furnish such revised Contract Documents to the Contractor. The Contractor shall notify the Owner and Architect of any inconsistencies between the Control Estimate and the revised Contract Documents.

§ 15.3 Applications for Payment

§ 15.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 15.1, for completed portions of the Work. The application shall be notarized, if required; be supported by all data substantiating the Contractor's right to payment that the Owner or Architect require; shall reflect retainage if provided for in the Contract Documents; and include any revised cost control information required by Section 15.2.4. Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 15.3.2 With each Application for Payment where the Contract Sum is based upon the Cost of the Work, or the Cost of the Work with a Guaranteed Maximum Price, the Contractor shall submit payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached, and any other evidence required by the Owner to demonstrate that cash disbursements already made by the Contractor on account of the Cost of the Work equal or exceed progress payments already received by the Contractor plus payrolls for the period covered by the present Application for Payment, less that portion of the progress payments attributable to the Contractor's Fee.

§ 15.3.3 Payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment stored, and protected from damage, off the site at a location agreed upon in writing.

§ 15.3.4 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or other encumbrances adverse to the Owner's interests.

§ 15.4 Certificates for Payment

§ 15.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner of the Architect's reasons for withholding certification in whole or in part as provided in Section 15.4.3.

§ 15.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluations of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment in the amount certified.

Init.

The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 15.4.3 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 15.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 15.4.1. If the Contractor and the Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 9.2.2, because of

- .1 defective Work not remedied;
- .2 third-party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 15.4.4 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 15.4.3, in whole or in part, that party may submit a Claim in accordance with Article 21.

§ 15.5 Progress Payments

§ 15.5.1 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to sub-subcontractors in a similar manner.

§ 15.5.2 Neither the Owner nor Architect shall have an obligation to pay or see to the payment of money to a Subcontractor or supplier except as may otherwise be required by law.

§ 15.5.3 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 15.5.4 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 15.6 Substantial Completion

§ 15.6.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 15.6.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 15.6.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. When the Architect determines that the Work or designated portion thereof is substantially complete, the Architect will issue a Certificate of Substantial Completion which shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 15.6.4 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 15.7 Final Completion and Final Payment

§ 15.7.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions stated in Section 15.7.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 15.7.2 Final payment shall not become due until the Contractor has delivered to the Owner a complete release of all liens arising out of this Contract or receipts in full covering all labor, materials and equipment for which a lien could be filed, or a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including costs and reasonable attorneys' fees.

§ 15.7.3

(Paragraphs deleted)

§ 15.7.4 Acceptance of final payment by the Contractor, a Subcontractor or supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of the final Application for Payment.

ARTICLE 16 PROTECTION OF PERSONS AND PROPERTY

§ 16.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation, or replacement in the course of construction.

The Contractor shall comply with, and give notices required by, applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons and property and their protection from

damage, injury, or loss. The Contractor shall promptly remedy damage and loss to property caused in whole or in part by the Contractor, a Subcontractor, a sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 16.1.2 and 16.1.3. The Contractor may make a claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 9.15.

§ 16.2 Hazardous Materials and Substances

§ 16.2.1 The Contractor is responsible for compliance with the requirements of the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents, and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 16.2.2 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area, if in fact, the material or substance presents the risk of bodily injury or death as described in Section 16.2.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 16.2.3 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

ARTICLE 17 INSURANCE AND BONDS

§ 17.1 Contractor's Insurance

§ 17.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in this Section 17.1 or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the insurance required by this Agreement from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 18.4, unless a different duration is stated below:

§ 17.1.2 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than (\$) each occurrence, (\$) general aggregate, and (\$) aggregate for products-completed operations hazard, providing coverage for claims including

- .1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
- .2 personal and advertising injury;
- .3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
- .4 bodily injury or property damage arising out of completed operations; and
- .5 the Contractor's indemnity obligations under Section 9.15.

§ 17.1.3 Automobile Liability covering vehicles owned by the Contractor and non-owned vehicles used by the Contractor, with policy limits of not less than (\$) per accident, for bodily injury, death of any person, and property

damage arising out of the ownership, maintenance, and use of those motor vehicles along with any other statutorily required automobile coverage.

§ 17.1.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as those required under Section 17.1.2 and 17.1.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ 17.1.5 Workers' Compensation at statutory limits.

§ 17.1.6 Employers' Liability with policy limits not less than (\$) each accident, (\$) each employee, and (\$) policy limit.

§ 17.1.7 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than (\$) per claim and (\$) in the aggregate.

§ 17.1.8 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than (\$) per claim and (\$) in the aggregate.

§ 17.1.9 Coverage under Sections 17.1.7 and 17.1.8 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than (\$) per claim and (\$) in the aggregate.

§ 17.1.10 The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Section 17.1 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the period required by Section 17.1.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy.

§ 17.1.11 The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ 17.1.12 To the fullest extent permitted by law, the Contractor shall cause the commercial liability coverage required by this Section 17.1 to include (1) the Owner, the Architect, and the Architect's Consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's Consultants, CG 20 32 07 04.

§ 17.1.13 Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by this Section 17.1, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 17.1.14 Other Insurance Provided by the Contractor

(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Init.

Coverage

Limits

§ 17.2 Owner's Insurance

§ 17.2.1 Owner's Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 17.2.2 Property Insurance

§ 17.2.2.1 The Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed or materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section 17.2.2.2, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ 17.2.2.2 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section 17.2.2.1 or, if necessary, replace the insurance policy required under Section 17.2.2.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 18.4.

§ 17.2.2.3 If the insurance required by this Section 17.2.2 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ 17.2.2.4 If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 18.4, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ 17.2.2.5 Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Section 17.2.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by this Section 17.2.2. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ 17.2.2.6 Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any insurance required by this Section 17.2.2, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 17.2.2.7 Waiver of Subrogation

§ 17.2.2.7.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by this Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and

Init.

sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this Section 17.2.2.7 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 17.2.2.7.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 17.2.2.7.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 17.2.2.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements, written where legally required for validity, the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 17.2.3 Other Insurance Provided by the Owner

(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage

Limits

§ 17.3 Performance Bond and Payment Bond

§ 17.3.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in the Contract Documents on the date of execution of the Contract.

§ 17.3.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 18 CORRECTION OF WORK

§ 18.1 The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed, or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense, unless compensable under Section A.1.7.3 in Exhibit A, Determination of the Cost of the Work.

§ 18.2 In addition to the Contractor's obligations under Section 9.4, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 15.6.3, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty.

§ 18.3 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Section 8.3.

§ 18.4 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 18.5 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Article 18.

ARTICLE 19 MISCELLANEOUS PROVISIONS

§ 19.1 Assignment of Contract

Neither party to the Contract shall assign the Contract without written consent of the other, except that the Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 19.2 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 21.6.

§ 19.3 Tests and Inspections

Tests, inspections, and approvals of portions of the Work required by the Contract Documents or by applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 19.4 The Owner's representative:

(Name, address, email address and other information)

§ 19.5 The Contractor's representative:

(Name, address, email address and other information)

§ 19.6 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

ARTICLE 20 TERMINATION OF THE CONTRACT

§ 20.1 Termination by the Contractor

If the Architect fails to certify payment as provided in Section 15.4.1 for a period of 30 days through no fault of the Contractor, or if the Owner fails to make payment as provided in Section 4.1.3 for a period of 30 days, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 20.2 Termination by the Owner for Cause

§ 20.2.1 The Owner may terminate the Contract if the Contractor

- .1 refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 20.2.2 When any of the reasons described in Section 20.2.1 exists, the Owner, may, without prejudice to any other remedy the Owner may have and after giving the Contractor seven days' notice, terminate the Contract and take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor and may finish the Work by whatever reasonable method the Owner may deem expedient. Upon request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 20.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 20.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 20.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Architect, upon application, and this obligation for payment shall survive termination of the Contract.

§ 20.3 Termination by the Owner for Convenience

The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause. The Owner shall pay the Contractor for Work executed; and costs incurred by reason of such termination, including costs attributable to termination of Subcontracts; and a termination fee, if any, as follows:

(Insert the amount of or method for determining the fee payable to the Contractor by the Owner following a termination for the Owner's convenience, if any.)

ARTICLE 21 CLAIMS AND DISPUTES

(Paragraphs deleted)

§ 21.1 Unless the parties agree otherwise in writing, any claim, dispute or other matter in question arising out of or related to this Agreement shall be subject to mediation provided herein as a condition precedent to litigation:

- .1 The party bringing a claim shall give notice to the other party and, in writing, propose a meeting within fourteen (14) days after the claim arises in which to discuss and attempt to resolve the claim.
- .2 In the event the meeting between the parties to resolve the claim does not resolve the dispute or does not take place within said fourteen (14) day period, the parties shall designate, by mutual agreement, an independent mediator who shall convene a meeting of the parties within a period of fourteen (14) days of the later of the initial meeting between the parties or the date notice was given pursuant to subsection 21.1.1. The mediator shall render his or her decision within fourteen (14) days of said meeting.
- .3 The purpose of mediation is to attempt to resolve the dispute between the parties. The mediator shall not be empowered with the authority to render a binding opinion or award.
- .4 In the event the independent mediator's attempt to resolve the dispute between the parties fails, then each party will be free to pursue recover of claims at law.
- .5 During the pendency of this alternative dispute resolution process, the parties agree that any statute of limitations applicable to all claims that are the subject of this process shall be tolled.

§ 21.10 Continuing Contract Performance

Pending final resolution of a Claim, except as otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*

CONTRACTOR *(Signature)*

(Printed name and title)

(Printed name and title)

32732467.1\107063-00005

(Paragraphs deleted)

(Table deleted)

DRAFT

Init.

Additions and Deletions Report for AIA® Document A104™ – 2017

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 15:36:13 ET on 01/09/2019.

PAGE 1

Ferndale Public Schools
871 Pincrest Drive
Ferndale, MI 48220

...

17226-4000 Ferndale Public Schools
Ferndale Public Schools
Ferndale High School
IDS Project No. 17226-4000

...

Integrated Design Solutions, L.L.C.
1441 West Long Lake Road
Suite 200
Troy, MI 48098
Telephone Number: (248) 823-2100
Fax Number: (248) 823-2200

PAGE 3

§ 2.4 Extension of Time. The Contractor agrees that time is of the essence of this Contract. Any extensions of the Substantial Completion Date shall only be granted to the extent that the delay: (1) has not been caused by the Contractor (including labor disputes involving Contractor's personnel or Subcontractor's personnel and late or delayed deliveries of materials or equipment to Contractor or Subcontractor); (2) is of a duration of not less than three (3) days; (3) is not concurrent with any other delay; and (4) is an addition to any time contingency periods set forth in the critical path for completion of the Work. Delays caused by unusual or adverse weather conditions shall not be grounds for extensions of the Substantial Completion Date or claims for additional compensation.

...

§ 3.2 The Stipulated Sum shall be (\$), subject to written authorized additions and deductions as provided in the Contract Documents.

PAGE 4

§ 3.3 Cost of the Work Plus Contractor's Fee Contract Sum and Limitation of Damages. The Owner agrees to pay and the Contractor agrees to accept the sum set forth in the Contract Sum as full compensation for all labor, supervision, equipment, home office and field overhead, administrative and incidental expense required in executing all of the Work contemplated in this contract as set forth in the plans and specifications, including all loss or damage arising out of the Work, as impacted by the elements or from any obstruction, delay or difficulties which may be encountered. It is further agreed that the Work may be modified, in nature or scope and that the Contract Sum may likewise be

modified only in accordance with the Contract Documents. No claims for extra compensation or adjustments in the Contract Sum will be made by or due to the Contractor on account of delay, costs incurred as a result of variations within the as-planned schedule, or the failure of others to complete any of the Work as scheduled. The Contractor agrees that its only remedy for delay shall be extension of time if justified under subparagraph 2.4 above

§ 3.3.1 The Cost of the Work is as defined in Exhibit A, Determination of the Cost of the Work.

§ 3.3.2 The Contractor's Fee:

(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee and the method of adjustment to the Fee for changes in the Work.)

§ 3.4 Cost of the Work Plus Contractor's Fee With a Guaranteed Maximum Price

§ 3.4.1 The Cost of the Work is as defined in Exhibit A, Determination of the Cost of the Work.

§ 3.4.2 The Contractor's Fee:

(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee and the method of adjustment to the Fee for changes in the Work.)

§ 3.4.3 Guaranteed Maximum Price

§ 3.4.3.1 The sum of the Cost of the Work and the Contractor's Fee is guaranteed by the Contractor not to exceed — (\$), subject to additions and deductions by changes in the Work as provided in the Contract Documents. This maximum sum is referred to in the Contract Documents as the Guaranteed Maximum Price. Costs which would cause the Guaranteed Maximum Price to be exceeded shall be paid by the Contractor without reimbursement by the Owner. *(Insert specific provisions if the Contractor is to participate in any savings.)*

§ 3.4.3.2 The Guaranteed Maximum Price is based on the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

§ 3.4.3.3 Unit Prices, if any:

(Identify the item and state the unit price and the quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit (\$0.00)
------	-----------------------	-------------------------

§ 3.4.3.4 Allowances, if any, included in the Guaranteed Maximum Price:

(Identify each allowance.)

Item	Price
------	-------

§ 3.4.3.5 Assumptions, if any, on which the Guaranteed Maximum Price is based:

§ 3.4.3.6 To the extent that the Contract Documents are anticipated to require further development, the Guaranteed Maximum Price includes the costs attributable to such further development consistent with the Contract Documents and reasonably inferable therefrom. Such further development does not include changes in scope, systems, kinds and quality of materials, finishes or equipment, all of which, if required, shall be incorporated by Change Order.

~~§ 3.4.3.7 The Owner shall authorize preparation of revisions to the Contract Documents that incorporate the agreed-upon assumptions contained in Section 3.4.3.5. The Owner shall promptly furnish such revised Contract Documents to the Contractor. The Contractor shall notify the Owner and Architect of any inconsistencies between the agreed-upon assumptions contained in Section 3.4.3.5 and the revised Contract Documents.~~

...

§ 4.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner ~~shall~~ shall, after approval, make payment of the certified amount to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the date fixed above, payment shall be made by the Owner not later than () days after the Architect receives the Application for Payment.

PAGE 5

For any claim subject to, but not resolved by, mediation pursuant to Section ~~21.5~~, 21.1, the method of binding dispute resolution shall be as follows:

...

☒ [X] Litigation in a court of competent jurisdiction

...

§ 6.1 The Contract Documents are defined in Article 7 and, except for Modifications issued after execution of this Agreement, are enumerated in the sections below. Whenever any reference is made to "Standard Form" AIA documents, such references shall be read to include any amendments to the standard form approved in writing by the parties.

PAGE 9

If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents, or ~~repeatedly~~ fails to carry out the Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order is eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

PAGE 10

§ 9.6.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for ~~the building permit as well as other~~ any applicable permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 9.6.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work. If the Contractor performs Work ~~knowing it to be~~ contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

PAGE 11

The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. The Contractor shall be responsible for finishing the Work so that areas which required cutting, fitting, or patching match and blend in unnoticeable with the surrounding areas

...

The Contractor shall keep the premises and surrounding area clean and free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus material from and about the Project.

...

§ 9.15.1 To the fullest extent permitted by law, the Contractor shall ~~indemnify~~ indemnify, defend and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 9.15.1.

PAGE 14

§ 14.5 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) changes ordered in the Work; (2) by ~~labor disputes, fire, unusual delay in deliveries, abnormal adverse weather conditions not reasonably anticipatable,~~ unavoidable casualties, or any causes beyond the Contractor's control; or (3) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine, subject to the provisions of Article ~~21.21~~ and Section 2.4.

PAGE 17

§ 15.7.3 The making of final payment shall constitute a waiver of claims by the Owner except those arising from
~~.1 — liens, claims, security interests or encumbrances arising out of the Contract and unsettled;
.2 — failure of the Work to comply with the requirements of the Contract Documents;
.3 — terms of special warranties required by the Contract Documents; or
.4 — audits performed by the Owner, if permitted by the Contract Documents, after final payment.~~

PAGE 23

~~.1 repeatedly~~ refuses or fails to supply enough properly skilled workers or proper materials;

...

~~.3 repeatedly~~ disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

...

§ 20.2.2 When any of the reasons described in Section 20.2.1 exists, the Owner, ~~upon certification by the Architect that sufficient cause exists to justify such action,~~ may, without prejudice to any other remedy the Owner may have and after giving the Contractor seven days' notice, terminate the Contract and take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor and may finish the Work by whatever reasonable method the Owner may deem expedient. Upon request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

...

§ 21.1 ~~Claims, disputes, and other matters in question arising out of or relating to this Contract, including those alleging an error or omission by the Architect but excluding those arising under Section 16.2, shall be referred initially to the Architect for decision. Such matters, except those waived as provided for in Section 21.11 and Sections 15.7.3 and 15.7.4, shall, after initial decision by the Architect or 30 days after submission of the matter to the Architect, be subject to mediation as a condition precedent to binding dispute resolution.~~

§ 21.2 Notice of Claims

§ 21.2.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 18.2, shall be initiated by notice to the Architect within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 21.2.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 18.2, shall be initiated by notice to the other party.

§ 21.3 Time Limits on Claims

The Owner and Contractor shall commence all claims and causes of action against the other and arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in this Agreement whether in contract, tort, breach of warranty, or otherwise, within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 21.3.

§ 21.4 If a claim, dispute or other matter in question relates to or is the subject of a mechanic's lien, the party asserting such matter may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 21.5 The parties shall endeavor to resolve their disputes by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with their Construction Industry Mediation Procedures in effect on the date of this Agreement. A request for mediation shall be made in writing, delivered to the other party to this Agreement, and filed with the person or entity administering the mediation. The request may be made concurrently with the binding dispute resolution but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 21.6 If the parties have selected arbitration as the method for binding dispute resolution in this Agreement, any claim, subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association, in accordance with the Construction Industry Arbitration Rules in effect on the date of this Agreement. Demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 21.7 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation; (2) the arbitrations to be consolidated substantially involve common questions of law or fact; and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 21.8 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, any party to an arbitration may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of a Claim not described in the written Consent.

§ 21.9 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to this Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 21.1 Unless the parties agree otherwise in writing, any claim, dispute or other matter in question arising out of or related to this Agreement shall be subject to mediation provided herein as a condition precedent to litigation:

- .1 The party bringing a claim shall give notice to the other party and, in writing, propose a meeting within fourteen (14) days after the claim arises in which to discuss and attempt to resolve the claim.
- .2 In the event the meeting between the parties to resolve the claim does not resolve the dispute or does not take place within said fourteen (14) day period, the parties shall designate, by mutual agreement, an independent mediator who shall convene a meeting of the parties within a period of fourteen (14) days of the later of the initial meeting between the parties or the date notice was given pursuant to subsection 21.1.1. The mediator shall render his or her decision within fourteen (14) days of said meeting.
- .3 The purpose of mediation is to attempt to resolve the dispute between the parties. The mediator shall not be empowered with the authority to render a binding opinion or award.
- .4 In the event the independent mediator's attempt to resolve the dispute between the parties fails, then each party will be free to pursue recover of claims at law.
- .5 During the pendency of this alternative dispute resolution process, the parties agree that any statute of limitations applicable to all claims that are the subject of this process shall be tolled.

PAGE 24

This Agreement entered into as of the day and year first written above.

OWNER (Signature)

CONTRACTOR (Signature)

(Printed name and title)

(Printed name and title)

32732467.1\107063-00005 § 21.11-Waiver of Claims for Consequential Damages

The Contractor and Owner waive claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 20. Nothing contained in this Section 21.11 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

This Agreement entered into as of the day and year first written above.

OWNER (Signature)

CONTRACTOR (Signature)

(Printed name and title)

(Printed name and title)

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 15:36:13 ET on 01/09/2019 under Order No. 7445430279 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A104™ – 2017, Standard Abbreviated Form of Agreement Between Owner and Contractor , as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)

(Title)

(Dated)

SECTION 00 7300 - SUPPLEMENTARY CONDITIONS AND ADDITIONAL CONDITIONS

PROJECT: Ferndale Public Schools
Ferndale High School and Ferndale Middle School
Select Toilet Room Renovations
Ferndale, Michigan

OWNER: Ferndale Public Schools
Central Offices
Ferndale High School, 3rd Floor, Room 326
871 Pinecrest
Ferndale, Michigan 48220

ARCHITECT: Integrated Design Solutions, LLC
Architecture, Engineering, Interiors & Technology

1441 W. Long Lake Road, Suite 200
Troy, MI 48098
5211 Cascade Road, SE, Suite 300
Grand Rapids, Michigan 49546

(248) 823-2100
(248) 823-2200 fax
www.ids-troy.com

THE FOLLOWING SUPPLEMENTS MODIFY AIA DOCUMENT A104-2017, "STANDARD ABBREVIATED FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR". WHERE A PORTION OF THE GENERAL CONDITIONS IS MODIFIED OR DELETED BY THESE SUPPLEMENTARY CONDITIONS, THE UNALTERED PORTIONS OF THE GENERAL CONDITIONS SHALL REMAIN IN EFFECT.

**EXPLANATION
OF NUMBERING:** Article 22 shall constitute revisions and additions to and follow the same format of the General Conditions.

ARTICLE 22

OTHER CONDITIONS OR PROVISIONS

- 22.1 Add new subparagraph 7.1.1 as follows:
- 7.1.1 In the case of conflicts or discrepancies between Drawings and the Specifications or within or among the Contract Documents and not clarified by Addendum, the Architect will determine which takes precedence in accordance with Sections 10.7, 10.7.1 and 10.8.
- 22.2 Add new subparagraph 7.5.3 as follows:
- 7.5.3 The Contractor will be responsible for printing and distributing copies of Drawings and Project Manuals for execution of the Work.
- 22.3 Delete subparagraph 8.1.1 in its entirety.
- 22.4 Delete subparagraph 8.1.2 in its entirety.

22.5 Delete subparagraph 9.9.1 and add the following in its place:

9.9.1 The Contractor shall review for compliance with the Contract Documents, approve in writing and submit to the Architect all Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in coordination with the Contractor's construction schedule and in such sequence as to allow the Architect reasonable time for review. By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has 1) reviewed and approved them; 2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so; and 3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents. At the time of submission, the Contractor shall inform the Architect in writing of any deviation in the Shop Drawings, Product Data and Samples from the requirements of the Contract Documents. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Architect without action. The Work shall be in accordance with approved submittals.

22.6 Add new paragraph 10.10 as follows:

10.10 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of Drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both the Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

22.7 Delete subparagraph 13.2 and add the following in its place:

13.2 The cost or credit to the Owner resulting from a change in the work shall be determined by mutual agreement, by an acceptable estimate and lump sum proposal by the Contractor, by actual cost of all labor and materials and a percentage or fixed fee for all other changes, such as overhead, profit, insurance, taxes and bonds or in the case of a Construction Change Directive signed only by the Owner and Architect, by the Contractor's cost of labor, material, equipment and reasonable overhead and profit. On any change which involves a net credit to the Owner, no allowance for overhead and profit shall be figured.

13.2.1 If none of the foregoing methods is agreed upon, the Contractor, upon receipt of an order as hereinbefore stated, shall proceed with the work. In such case the Contractor shall keep and present in such form as the Owner may direct, a correct account of the cost, together with vouchers. In any case, the Owner shall certify to the amount including the specified allowance for overhead and profit, due the Contractor.

13.2.2 The combined overhead and profit included in the total cost to the Owner for a change in the Work shall be based on the following schedule.

- .1 For the Contractor, for Work performed by the Contractor's own forces 15 percent of the cost.
- .2 For the contractor, for Work performed by the Contractor's Subcontractors 7-1/2 percent the amount due the Subcontractors.
- .3 For each Subcontractor involved, for Work performed by that Subcontractor's own forces, 15 percent of the cost.
- .4 For each Subcontractor involved, for work performed by the Subcontractor's, Sub-subcontractor's 7-1/2 percent of the amount due the Sub-subcontractor.
- .5 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials, and Subcontracts. In no case will a change be approved without such itemization.

22.8 Add the following after subparagraph 15.3.1

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

.1 Until final completion, the Owner will pay ninety (90) percent of the amount due the Contractor on account of progress payments. Upon final completion, the Architect will certify payment in full.

22.9 Delete Article 15.2 in its entirety.

22.10 Delete subparagraphs 17.1.2 through 17.1.9 and add the following:

"17.1.2 The insurance required by Subparagraph 17.1 shall be written for not less than the following limits, or greater if required by law:

1. Worker's Compensation:

a. State:	Statutory
b. Applicable Federal (e.g. Longshoremen's):	Statutory
c. Employer's Liability:	\$1,000,000.00 per Accident \$1,000,000.00 Disease, Policy Limit \$1,000,000.00 Disease, Each Employee

2. Comprehensive or Commercial General Liability (including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage);

a. Bodily Injury:

\$5,000,000.00	Each Occurrence
\$5,000,000.00	Aggregate

b. Property Damage:

\$1,000,000.00	Each Occurrence
\$1,000,000.00	Aggregate

c. Products and Completed Operations to be maintained for one (1) year after final payment:

\$1,000,000.00	Aggregate
----------------	-----------

d. Broad Form Property Damage Coverage shall include Completed Operations.

3. Contractual Liability:

a. Bodily Injury:

\$1,000,000.00	Each Occurrence
\$1,000,000.00	Aggregate

b. Property Damage:

\$1,000,000.00	Each Occurrence
\$1,000,000.00	Aggregate

4. Personal Injury, with Employment Exclusion deleted:

\$1,000,000.00	Aggregate
----------------	-----------
5. Business Auto Liability (including owned, non-owned and hired vehicles):
 - a. Bodily Injury:

\$1,000,000.00	Each Person
\$1,000,000.00	Each Occurrence
 - b. Property Damage:

\$1,000,000.00	Each Occurrence
----------------	-----------------
6. Umbrella Excess Liability
 (Bodily Injury and Property Damage
 Combined)

	\$1,000,000.00
--	----------------

"17.1.3" Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis including:

1. Premises Operations (including X, C, and U coverages as applicable).
2. Independent Contractor's Protective.
3. Products and Completed Operations.
4. Personal Injury Liability with Employment Exclusion deleted.
5. Owned, non-owned and hired motor vehicles.
6. Broad Form Property Damage including Completed Operations.

17.1.4 If the General Liability coverages are provided by a Commercial General Liability Policy on a claims-made basis, the policy date or Retroactive Date shall predate the Contract; the termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment, certified in accordance with Subparagraph 9.10.2.

- 22.11 Delete subparagraph 17.2.2.7 in its entirety.
- 22.12 Delete subparagraph 17.2.2.7.1 in its entirety.
- 22.13 Delete subparagraph 17.2.2.7.2 in its entirety.
- 22.14 Delete subparagraph 17.3.1 and add the following in its place.

"17.3.1 The Owner shall have the right, prior to the signing of the Contract, to require the Contractor to furnish good and satisfactory bonds covering the faithful performance of the Contract, and the payment of all obligations arising thereunder, in such form as the Owner may prescribe and with such sureties as the Owner may approve. If such bonds are required by instructions given previous to the submission of bids, the premium shall be paid by the Contractor; if subsequent thereto, it shall be paid by the Owner.

"17.3.1 The Contractor shall furnish a Performance Bond and a Labor and Material Payment Bond covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds shall be obtained from a company licensed to do business in the State of Michigan and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal to 100 percent of the Contract Sum.

17.3.1.1 The Contractor shall deliver the required bonds to the Owner not later than three days following the date the Agreement is entered into, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.

22.15 Add the following after subparagraph 20.3.

"20.3.1 Upon receipt of written note from the Owner of such termination for the Owner's convenience, the Contractor shall:

1. Cease operations as directed by the Owner in the notice;
2. Take actions necessary, or that the Owner may direct, for the protection and preservation of the work; and
3. Except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing Subcontracts and purchase orders and enter into no further Subcontracts and purchase orders.

22.16 EQUAL OPPORTUNITY

22.12.1. The Contractor shall maintain policies of employment as follows:

22.12.2. The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

22.12.3. The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

END OF SECTION 00 7300

SECTION 01 1000 – GENERAL REQUIREMENTS

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. Project Identification.
 - 2. Summary of Work.
 - 3. Work Restrictions.
 - 4. Contract Modification Procedures.
 - 5. Payment Procedures.
 - 6. Project Management and Coordination.
 - 7. Submittal Procedures.
 - 8. References.
 - 9. Temporary Facilities and Controls, including temporary protections of existing flooring.
 - 10. Product Requirements.
 - 11. Execution Requirements.
 - 12. Cutting and Patching.
 - 13. Progress Cleaning.
 - 14. Closeout Procedures.
 - 15. Final Cleaning.

1.3 PROJECT IDENTIFICATION

- A. Project Title: Ferndale High School and Ferndale Middle School Select Toilet Room Renovations.
 - 1. Owner: Ferndale Public Schools.
 - 2. Project Location: Ferndale, Michigan
- B. Architect and MEP Engineer:
 - 1. Integrated Design Solutions, 1441 W. Long Lake Road, Suite 200, Troy, Michigan 48098.
- C. Project Web Site: A project Web site administered by Architect will be used for purposes of managing communication and documents during the bidding and construction stage.
 - 1. Project Web Site: Project Web sites will be used for purposes of managing communication and documents during the bidding and construction stage.
 - a. The Bidding documents, are available at the following web site
 - 1) Michigan Statewide Integrated Governmental Management Applications system (SIGMA):<https://milogintp.michigan.gov/eai/tplogin>
 - b. The Bidding documents are also available at the following web site
 - 1) <http://cloud.ids-troy.com/bids/bids/ferndale/Select-Toilet-Room-Renovations-2019/>

1.4 SUMMARY OF THE WORK

- A. Summary of the Work: The Work of Project is defined by the Contract Documents and consists of the following:
1. All work required to provide Select Toilet Room Renovations includes, but is not limited to:
 - a. Selective demolition.
 - b. Concrete work.
 - c. Masonry work
 - d. Doors frames.
 - e. Tiling.
 - f. Painting.
 - g. Toilet compartments.
 - h. Toilet and bath accessories.
 - i. Mechanical scope refer to Section 22 0500 Common Work Results for Mechanical.
 - j. Electrical scope refer to Section 26 0500 Common Work Results for Electrical.
 - k. Cleaning of all spaces so as to be ready for occupancy.
- B. Type of Contract:
1. Project will be constructed under a single lump sum general contract.
- C. Ordinances and Fees:
1. All work shall be executed in accordance with the rules and regulations of the 2015 State of Michigan Building Code and Bureau of Fire Services Rules for Schools, Colleges and Universities 2015, incorporating the 2012 Edition of NFPA 101 Life Safety Code.
 2. No permits (local) are required.
- D. Supervision and Construction Procedures: The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures, and for coordinating all portions of the Work under the Contract. The Contractor shall be fully and solely responsible for the jobsite safety of such means, methods, techniques sequences or procedures. There will be an Owner's Representative assigned to the project.
- E. Packing, Removing, Storage and Reinstallation of Existing Furniture, Furnishings, Equipment and Belongings: Prior to start of construction in each room or area, Contractor pack and move all furniture, furnishings, equipment and supplies from each area to allow access for work activities. Furniture, furnishings and equipment may be temporarily stored in the Gymnasium. Provide temporary floor protection prior to storing anything on Gymnasium floor.
1. Upon completion of construction in each room or area, including cleaning, Contractor shall move all furniture, furnishings, equipment and belongings back to original location. Furniture shall be set in original locations except as directed by Owner.
 2. Owner will remove electronics and associated cabling and accessories

1.5 WORK RESTRICTIONS

- A. On-Site Work Hours: Limit work in the existing building to normal business working hours of 6:30 a.m. to 6:00 p.m., Monday through Friday, unless otherwise indicated.

1. Work done after hours may be allowed subject to prior approval from the Owner.
 2. Work done during school hours may be allowed subject to prior approval from the Owner and provided work area is cleaned and ready for use the next day.
- B. Use of Premises: Limit the use of the premises to work in areas indicated. Do not disturb portions of the site beyond areas in which the Work is indicated. Allow for Owner occupancy. Contractor to be responsible to maintain fire alarm system during construction or assume responsibility if the system is put in the test mode.
1. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
- C. Use of Existing Building: Maintain the existing building in a weather-tight and secure condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.
1. The Contractor and each Subcontractor will be expected to have visited the site and appraise the existing situation and circumstances of operation.
 2. Consult with the Owner as to the availability of space for storage of materials and places of access to the work, etc. Materials and equipment must be placed to avoid interferences with the Owner's operations and shall be moved when so required.
 3. Comply with the Owner's requirements with regard to entrance, movement within and exit of all trucks, equipment, and personnel.
 4. The Owner reserves the right to perform construction work similar in nature to the work included under this Contract, in the same area concurrently with the Contractor, with his own forces, or with other Contractors, without conflict of any nature.
- D. Maintaining Service and Functions:
1. The school will not be occupied during summer months but all work must be complete, operational and all areas clean by Friday, August 16, 2019.
 2. The nature of this project is such that close coordination will be required of the Contractor with the Owner, other Contractors, and others having an interest in the project to assure that work on the site, access to and from the site, and the general conduct of operations is maintained in a safe and efficient manner, and that disruption and inconvenience is minimized.
- E. Fire Alarm System and Security Alarm System: During construction the Contractor is responsible to maintain the fire alarm system and security system in good working order.
1. At end of each day's shift the Contractor shall be required to ensure the building is locked and both fire alarm system and security system are operational.
- F. Owner's Right to Place Equipment: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building, prior to Substantial Completion, provided that such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.
- G. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
- H. Damage to Other Work: The Contractor shall repair, replace, or touch-up all finished surfaces in the existing building which may be damaged as a result of his work or operations.

- I. Utilities or other services encountered or otherwise found shall be protected from any damage, unless or until they are abandoned. If the utilities or services are not abandoned, immediately repair any damage from work and operations of this Contract. Immediately repair any damage from the Work or operations and restore the utilities and services to an equal or better condition than that which existing prior to the damage or disruption.
- J. Enforce strict discipline and good order among the Contractor's employees and subcontractor's.
 - 1. Foul or abusive language or demeanor will not be tolerated.
 - 2. Contractor's employees and subcontractor's shall dress in a neat workmanlike manner.
 - 3. Tobacco is prohibited anywhere on school property.
 - 4. Possession, sale or consumption of alcoholic beverages on Owner's property is strictly prohibited.
 - 5. The manufacturing, distribution, dispensing, possession or use of unlawful drugs on Owner's property is strictly prohibited and may result in criminal prosecution.

1.6 CONTRACT MODIFICATION PROCEDURES

- A. Architect's Supplemental Instructions: After award of Contract, the Architect has the authority to order minor changes in the Work, not involving adjustments in the contract sum or extension of the contract time and not inconsistent with the intent of the contract Documents.
- B. Bulletin: A written notice by the Architect to the Contractor requesting an itemized cost quotation for an addition, deletion, or revision in the Work, issued after award of contract. Bulletins are not an order or authorization to proceed with any changes in the Work. After award of Contract, the Contractor as required shall quote changes in the work described in Bulletins or otherwise.
- C. Construction Change Directive (CCD): A written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract sum or contract time or both.
 - 1. The Owner may, by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the construct Sum and Contract Time being adjusted accordingly.
- D. Except as otherwise specifically mentioned, the general character of the work covered by Bulletins or Construction Change Directives shall be the same as originally specified for the project and all incidental items required in connection with the work hereinafter described shall be included even though not specifically mentioned. Where an item is mentioned with no additional specifications given, reference is to be made to the original specifications. All applicable parts of the original specifications shall apply.
- E. Submit detailed itemized quotations for each item of work described, stating fully the amounts for additions and deductions.
- F. Following are sample guidelines for use in preparing detailed cost breakdown for each item in the Bulletin being quoted:
 - 1. Material Cost:
List material giving unit cost
x number of units = cost
Add sales tax
Add applicable shipping costs

Subtotal Material Cost

\$_____

2. Labor Cost - List for each trade the:
Hourly rate x number of hours =
Labor cost _____
- Add Labor Fringes as applicable:
F.I.C.A. _____
M.E.S.C. _____
Pension Contribution _____
Vacation Contribution _____
H.E.W. Insurance _____
- Subtotal Labor Cost \$ _____
3. Equipment (heavy, i.e. cranes, earth moving, hoists, etc.):
Rental Charge or equivalent per day or week (including operating costs except labor) _____
- Subtotal Equipment Cost \$ _____
4. Overhead & Profit
- a. Work performed by prime contractor
10% overhead and profit.
- b. On work performed by subcontractor,
The prime contractor is allowed 7-1/2% handling charge unless otherwise stated in Contract Documents.
- c. Work performed by subcontractor
10% overhead and profit
- Subtotal Overhead & Profit \$ _____
- TOTAL COST ITEM \$ _____

G. Quotations should be received by the Architect within two (2) weeks of issuance of the Bulletin.

H. If the Owner feels extra costs are not reasonable and the work is outside the Contract, the Owner reserves the right to get a second estimate, and if in the Owner's best interest, the Owner may engage that firm to do the Work.

1.7 PAYMENT PROCEDURES

A. Schedule of Values: Submit the Schedule of Values as a preliminary Application for Payment to the Architect at least 7 days before submittal of the initial Application for Payment.

1. Format and Content: Use AIA Documents G702 and G703. Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
- a. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
- b. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.

- c. Where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 - d. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
 - 1) At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.
- B. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
 - 1. The Application for Payment at time of Substantial Completion and the final Application for Payment involve additional requirements.
- C. Payment Application Forms: Use AIA Document G 702 and Continuation Sheets G 703 as the form for Application for Payment.
- D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Contractor. Incomplete applications will be returned without action.
 - 1. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- E. Transmittal: Submit 3 executed copies of each Application for Payment to the Architect. One copy shall be complete, including waivers of lien and similar attachments, when required.
 - 1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit final or full waivers.
 - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - 5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
 - 6. The General Contractor shall not hold payment to any subcontractor more than ten (10) days after payment has been received from the Owner unless there are documented issues with the subcontractor's work.
- G. Application for Payment at Substantial Completion: Actions and submittals that shall proceed or coincide with this application include:
 - 1. Warranties (guarantees) and maintenance agreements.
 - 2. Maintenance instructions.
 - 3. Final cleaning.
 - 4. Application for reduction of retainage, and consent of surety.

5. Punch list of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion. Please note, the Contractor shall include in their price one (1) week extra time for one (1) repair technician and one (1) programmer, whose sole function will be to finish all outstanding items after Substantial Completion.
- H. Final Payment Application: Actions and submittals that shall precede or coincide with this application include:
 1. Completion of Project closeout requirements.
 2. Completion of items specified for completion after Substantial Completion.
 3. Transmittal of required Project construction records to Owner.
 4. Proof that taxes, fees and similar obligations have been paid.
 5. Removal of temporary facilities and services.
 6. Removal of surplus materials, rubbish and similar elements.
- I. The Contractor warrants that title to all work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all work for which Certificates for Payment have been previously issued and payments received from the Owner shall be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, material and equipment relating to the Work.

1.8 PROJECT MANAGEMENT AND COORDINATION

- A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection and operation.
 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Pre-Construction Conference:
 1. Owner will schedule a pre-construction conference at the Project site after execution of the Agreement and prior to commencement of construction to review responsibilities and personnel assignments.
 2. Attendees: The Owner or their Representative, Architect, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference.

3. Agenda: Discuss items of significance that could affect progress including such topics as:

- a. Tentative construction schedule.
- b. Critical Work sequencing.
- c. Designation of responsible personnel.
- d. Procedures for processing field decisions and Change Orders.
- e. Procedures for processing Applications for Payment.
- f. Distribution of Contract Documents.
- g. Submittal of Shop Drawings, Product Data and Samples.
- h. Preparation of record documents.
- i. Use of the premises.
- j. Office, Work and storage areas.
- k. Equipment deliveries and priorities.
- l. Safety procedures.
- m. First aid.
- n. Security.
- o. Housekeeping.
- p. Working hours.

D. Progress Meeting:

- 1. Progress meetings, with the representatives of the various trades and the Contractor in attendance, will be held by the Architect and Owner at regular intervals as directed. The Minutes of these meetings will be recorded by the Contractor and copies sent to all interested parties. The dates of progress will be coordinated with preparation of payment request.
- 2. Agenda: Review and correct or approve minutes of the previous progress meeting. Include topics for discussion as appropriate to the current status of the Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Review including such items as:
 - 1) Interface requirements.
 - 2) Time.
 - 3) Sequences.
 - 4) Deliveries.
 - 5) Off-site fabrication problems.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and services.
 - 9) Hours of Work.
 - 10) Hazards and risks.
 - 11) Housekeeping.
 - 12) Quality and Work standards.
 - 13) Change Orders.
 - 14) Documentation of information for payment requests.

1.9 CONSTRUCTION PROGRESS DOCUMENTATION

- A. Construction Schedule: Submit a comprehensive, fully developed, horizontal bar chart, construction schedule.
1. Submit schedule within two (2) weeks after award of Contract. Base schedule on the Times of Completion specified for the Project.
 2. Update construction schedule monthly after construction progress meetings, to reflect actual construction progress and activities.
 3. Indicate each significant construction activity separately.
 4. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.
 5. Activities: Treat each story or separate area as a separate activity for each principal element of the Work. Comply with the following:
 - a. Procurement Activities: Include procurement activities for long lead items. Procurement activities include, but are not limited to, submittals, approvals, purchasing, fabrication and delivery.
 - b. Start-Up and Testing Time: Include time for start-up, testing and commissioning.
 - c. Substantial Completion: Indicate completion in advance of date of substantial completion, allow time for Architect's inspection and punch list.
 6. Constraints: Include constraints and work restrictions.
 - a. Phasing: Arrange list of activities on schedule by phase.
 - b. Work Restrictions: Show effect on the schedule of limitations of continued occupancies, uninterruptible services, use of premises restrictions, and provisions for future construction.
 - c. Work Stages: Indicate important stages of construction for each major portion of the Work.
 7. Milestones: Include milestones such as Notice to Proceed, Substantial Completion and Final Completion.
- B. Daily Construction Reports: Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Architect at weekly intervals:
1. List of subcontractors at the site.
 2. Approximate count of personnel at the site.
 3. High and low temperatures, general weather conditions.
 4. Accidents and unusual events.
 5. Meetings and significant decisions.
 6. Stoppages, delays, shortages, losses.
 7. Emergency procedures.
 8. Orders and requests of governing authorities.
 9. Change Orders received, implemented.
 10. Partial Completions, occupancies.
 11. Substantial Completions authorized.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for information (RFI). Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

- D. Special Reports: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
1. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1.10 SUBMITTAL PROCEDURES

- A. Definitions:
1. Action Submittals: Written and graphic information that requires Architect's responsive action. Submittals may be rejected for not complying with requirements.
 2. Informational Submittals: Written information that does not require Architect's approval.
 3. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
 4. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.
- B. Shop Drawings, Product Data and Samples: Submit Shop Drawings, Product Data and Samples to the Architect for review.
1. Architect will provide to the Contractor the submittal forms that must be filled out and accompany each submittal. Refer to Sample at the end of this Section.
 2. Coordinate the preparation and processing of submittals with the performance of the work. Coordinate each separate submittal with other submittals and related activities such as testing, purchasing, fabrication, delivery and similar activities and require sequential activity.
 - a. Coordinate the submittal of different units of interrelated work so that one submittal will not be delayed by the Architect's need to review a related submittal. The Architect reserves the right to withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.
 3. Allow sufficient time so that the installation will not be delayed as a result of the time required to properly process submittals, including time for resubmittal, if necessary.
 - a. Allow ten (10) working days for the Architect's review of each submittal. Allow a longer time period where processing must be delayed for coordination with subsequent submittals. The Architect will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.
 - b. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Architect/Engineer sufficiently in advance of the work.
 4. The Contractor shall review Shop Drawings, product Data and Samples prior to submission. Notify the Architect in writing of any deviations in the submittals from requirements of the Contract Documents.
 - a. Information required on shop drawings includes, dimensions, identification of specific products and materials which are included in the work, compliance with specified standards and notations of coordination requirements with other work.

- 1) Provide special notation of dimensions that have been established by field measurement.
 - 2) Highlight, encircle or otherwise indicate deviations from the contract documents on the shop drawings.
 - b. Submit samples for the Architect's visual review of general generic kind, color, pattern, and texture, and for a final check of the coordination of these characteristics with other related elements of the work. Samples are also submitted for quality control comparison of these characteristics between the final sample submittal and the actual work as it is delivered and installed.
 5. Architect's acceptance shall not relieve the Contractor from responsibility for errors in submittals.
 6. Do not use Shop Drawings, Product Data or Samples without an appropriate stamp indicating Architect/Engineer's action taken.
 7. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - a. No Exceptions Taken: Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
 - b. Exceptions As Noted: Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
 - c. Rejected: Do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
 - 1) Do not use, or allow others to use, submittals marked "Rejected" at the Project Site or elsewhere where Work is in progress.
 8. Informational Submittals: Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Construction Manager will forward each submittal to appropriate party.
 9. Action Not Required: Submittals not required by the Contract Documents will not be reviewed and will be returned with notation "Action Not Required."
- C. Electronic Submittal Procedure: Shop Drawings and Product Data shall be submitted electronically to the Architect for review. All submittals (except samples) must be electronic. The following instructions must be followed to minimize the risk of submittals being lost and to help expedite the review.
1. At Construction kick-off meeting the Architect will transmit to the contractor in both Word and PDF format the submittal form that must be used.
 2. Contractor prior to e-mailing to the Architect must fill out the following information on the submittal form.
 - a. Item (1) – From/Return to:
 - b. Item (2) – Project Title/Location:
 - c. Item (3) - IDS Project No.:
 - d. Item (4) – Submittal Date:
 - e. Item (8) – Project Manual Section No.:
 - f. Item (9) – Product Manufacturer:
 - g. Item (10) - Item Description (specific information, not just "drawings", i.e. Curtainwall Shop Drawings.
 - h. Item (11) – Print/Sepia/Catalog/Sample/Other (Quantity)
 - i. Item (12) – Contractor's/Construction Manager's Remarks & Deviations (if any).
 - j. Item (13) – Addendum or Bulletin (if any).
 - k. Item (14) – Substitution (if any).

3. Contractor shall e-mail the submittal to shopdrawings@ids-troy.com and the IDS Construction Administration individual. (Note: Not all submittals will be able to be received in the Construction Administration individuals e-mail due to e-mail limiting). The e-mail submittals should be formatted as follows:
 - a. Subject of e-mail should indicate the project name and specification section number and IDS project number.
 - b. Only one (1) specification section should be included in each e-mail. This aids in processing and future retrieval.
 - c. IDS submittal form must be completed and included at the beginning of and in the same PDF as the submittal (if the contractor chooses to use the Word format document to aid in filling in the information then they will need to convert it to a PDF and bind it into the actual submittal).

1.11 REFERENCES

A. Specifications & Drawings To be Cooperative:

1. These Specifications and accompanying Drawings are intended to describe and provide for finished work. They are intended to be cooperative and what is called for by either shall be as binding as if called for by both. The Drawings accompanying the Specifications are intended to show the general design and arrangement of the installation and in some cases are more or less diagrammatic. They are not intended to serve as shop drawings nor are they to be scaled for dimensions or exact locations of equipment.
2. It is the intent of the Drawings and Specifications to provide for a complete and satisfactory installation. The Contractor shall furnish Labor and/or materials neither shown nor specified but obviously necessary for the completion of the proper functioning of the systems.

B. Specification Format and Content Explanation:

1. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 49 Division format and MASTER FORMAT 2012 numbering system.
2. Words, which have well known technical or construction industry meanings are used in the Contract Documents in accordance with such, recognized meanings.
3. Abbreviated Language: In the interest of brevity, the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an" but the fact that a modifier or an article is absent from a statement and appears in another is not intended to affect the interpretation of either statement.
4. Trades: Use of titles such as "carpentry" is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

C. Definitions:

1. Contract Documents: Contract documents consist of the Agreement between Owner and Contractor, Conditions of the Contract, Drawings, Specifications, Addenda issued prior to execution of the Contract, and modifications issued after execution of the Contract. A modification is (1) a written amendment to the contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect (Architect's Supplemental Instructions). Contract Documents also includes bidding requirements or portions of Addenda relating to bidding requirements.
 - a. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

2. Indicated: Refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in Specifications, and similar requirements in Contract Documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used, it is to help locate the reference; no limitation on location is intended except as specifically noted.
 3. Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the Architect", "requested by the Architect", and similar phrases. However, no implied meaning shall be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.
 4. Approve: The term "approved", where used in conjunction with the Architect's action on the contractor's applications and requests, is limited to the duties and responsibilities of the Architect as stated in General and Supplementary Conditions. Such approval shall not release the Contractor from responsibility to fulfill Contract requirements unless otherwise provided in the Contract Documents.
 5. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work, whether lawfully imposed by authorities having jurisdiction or not.
 6. Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."
 7. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."
 8. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."
 9. Installer: An "Installer" is the Contractor engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 10. Project Site: Is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other construction activities as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.
 11. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.
- D. Standards of Industry: Reference to standards, codes, and recommendations shall be the latest edition of such publications adopted and published at date of bids. Work shall be installed according to the following industry standards when applicable:
1. UL - Underwriter's Laboratories, Inc.
 2. ASA - American Standard Association
 3. ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers
 4. ASME - American Society of Mechanical Engineers
 5. ASTM - American Society for Testing and Materials
 6. Any local state or national plumbing and building codes having jurisdiction.

1.12 TEMPORARY FACILITIES AND CONTROLS

- A. Temporary Water, Power and Lighting:
1. The Owner will furnish at no cost to the Contractor water and electricity for construction purposes. All such water and electricity shall be obtained from existing outlets designated by the Owner's Representative. If the Contractor's requirements exceed the characteristics at the designated outlets, the Contractor shall provide and pay for additional facilities as he may require.
 - a. Water shall not be taken from Fire Protection System.

2. Provide temporary distribution systems, transformers, pumps, outlets, lighting fixtures and other accessories as may require for construction operations. At completion, or when so directed by the Owner's Representative, remove all temporary facilities.
 3. All connections and distribution systems shall be furnished and installed by the Contractor at his own expense.
- B. Compressed Air: Each trade shall provide compressed air as required for the successful performance of their work.
- C. Temporary Toilets:
1. The Owner's will allow the use of designated toilet facilities for use by all workers employed on the project. Keep the facilities clean and in sanitary condition at all times.
 - a. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply.
- D. Temporary Field Office:
1. The Owner will make space available for the Contractor's temporary field office in the Pool. Provide all furniture and supplies as required for the temporary field office.
- E. Temporary Parking: Park in designated spaces only.
1. Do not park vehicles on sidewalks or lawn areas surrounding the building unless written approval is received from the Owner.
- F. Temporary Telephones: Provide cellular phone service for project superintendent.
- G. Janitorial Services: Provide janitorial services on a daily basis for temporary offices, toilets and similar areas.
- H. Temporary Storage: Construction trades may use areas designated by Owner.
- I. Temporary Protection of Existing Floors:
1. Provide temporary protection of existing finished floors (Carpet, Vinyl Composition Tile and Wood Gymnasium Floors) prior to construction and prior to moving furniture, furnishings and equipment.
 - a. The following are minimum requirements, provide additional protections as required by types of construction operations.
 2. For Carpet and Vinyl Composition Tile Floors: Use undyed, untreated building paper with joints taped.
 - a. Do not use plastic film or self adhering plastic film which could create a humidity chamber.
 3. For Wood Gymnasium Floors: Install temporary protection on Gymnasium Wood Floors, use smooth hardboard or plywood panels covered with undyed, untreated building paper, with joints taped.
 4. Any damage to existing floors caused by Contractor's operations and failure to maintain temporary protection will be repaired at no cost to Owner.
- J. Project Identification and Temporary Signs:
1. No advertising, contractor's sign or project sign will be permitted on the site.

1.13 PRODUCT REQUIREMENTS

A. Definitions:

1. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - a. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - b. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - c. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
2. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
3. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

B. Product Selection Procedures:

1. Proprietary Specification Requirements: Where a single product or manufacturer is named, provide only the product indicated.
2. Semi-proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated.
3. Available Manufacturers: Where Specifications include a list of "available" manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements.
4. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
 - a. Contractor will be completely responsible for any and all modifications required as a result of using a product that is not "Basis of Design".
5. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide only a product or assembly possessing the specified characteristics and that otherwise complies with Contract requirements.
6. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with indicated requirements, and are recommended by the manufacturer for the application indicated.
7. Compliance with Standards, Codes and Regulations: Where Specifications only require compliance with a code, standard or regulation, select a product that complies with the indicated standards, codes and regulations.
8. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.

- a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.
- 9. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
- C. Product Substitutions: Contractor's request for substitution will be received and considered when extensive revisions to the Contract Documents are not required, when the proposed changes are in keeping with the general intent of the contract documents, when the request are timely, fully documented and properly submitted, and when one or more of the following conditions is satisfied, all as judged by the Architect; otherwise the request will be returned without action except to record non-compliance with these requirements.
- D. The Architect will consider a request for substitution for the following reasons only:
 - 1. Where the request is directly related to an "or equal" clause in the contract documents.
 - 2. Where the specified product cannot be provided within the Contract Time. However, the request will not be considered if the product cannot be provided as a result of the Contractor's failure to pursue the work promptly or to coordinate the various activities properly.
 - 3. Where the specified product cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 - 4. Where a substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. These additional responsibilities may include such considerations as additional compensation to the Architect for redesign and evaluation services, the increased cost of other work by the Owner or separate contractors, and similar considerations.
 - 5. When the specified product cannot be provided in a manner which is compatible with other materials of the work, and where the Contractor certifies that the substitution will overcome the incompatibility.
 - 6. When the specified product cannot be properly coordinated with other materials in the work, and where the Contractor certifies that the proposed substitution can be properly coordinated.
 - 7. When the specified product cannot receive a warranty as required by the contract documents and where the contractor certifies that the proposed substitution receive the required warranty.
- E. Substitution Requests:
 - 1. Requests for Substitutions: Do not submit substitution request as a shop drawing submittal. Submit a separate request for each request for substitution. In each request identify the product to be replaced by the substitution, include related specification section and drawing numbers, and complete documentation showing compliance with the requirements for substitutions. Include the following information, as appropriate, with each request:
 - a. Provide complete product data, drawings and descriptions of products, and fabrication and installation procedures.
 - b. Provide samples if requested.
 - c. Provide a detailed comparison of the significant qualities of the proposed substitution with those of the work originally specified. Significant qualities include elements such as size, weight, durability, performance and visual effect.
 - d. Provide complete coordination information. Include all changes required in other elements of the work to accommodate the substitution.

- e. Provide a statement indicating the effect the substitution will have on the work schedule in comparison to the schedule without approval of the proposed substitution. Include information regarding the effect of the proposed substitution on the Contract Time.
- f. Provide complete cost information, including a proposal of the net change in the Contract Sum.
- g. Include in this certification, the Contractor's waiver of rights to additional payment or time, which may subsequently be necessary because of the failure of the substitution to perform adequately.

F. Sample Substitution Request Form: Use CSI Form 13.1A provided at end of Section

1.14 EXECUTION REQUIREMENT

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
- B. Establish benchmarks and markers to set lines and levels as needed to properly locate each element of the Work. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
- C. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- D. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- E. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- F. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. 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.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

J. Starting and Adjusting:

1. Coordinate schedule with Commissioning Agent prior to starting and adjusting equipment.
2. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
3. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
4. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation.

1.15 PROGRESS CLEANING

- A. Waste Material Removal and Cleaning: Remove and properly dispose of, on a daily basis all waste materials and debris resulting from the Work. The Project and adjacent grounds shall be kept free of accumulations of rubbish.
1. Construction debris shall not be stored overnight, nor shall it be left in common corridors. Keep debris confined to work areas only until such time as it is being removed.
 2. No burning of waste materials will be permitted on the premises.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
 2. Do not wash waste materials down sewers or into waterways
 3. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

1.16 CLOSEOUT PROCEDURES

A. Substantial Completion:

1. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - a. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - b. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - c. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction damage or settlement surveys, and similar final record information.
 - d. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - e. Terminate and remove temporary facilities from Project site, along with construction tools, and similar elements.
 - f. Complete final cleaning requirements, including touchup painting.
 - g. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
2. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
 - a. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - b. Results of completed inspection will form the basis of requirements for Final Completion.

B. Final Completion:

1. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
 - a. Submit a final Application for Payment according to Section 01290 "Applications for Payment."
 - b. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - c. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - d. Instruct Owner's personnel in maintenance of products.
2. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will review a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - a. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

C. At time of substantial completion, submit record drawings, maintenance manuals and warranties.

D. Record Shop Drawings and Product Data: Maintain one copy of shop drawings and product data. Mark these documents to show significant variations in actual Work performed.

E. Requirements For Maintenance Manuals:

1. Organization: Organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - a. Title page.
 - b. Table of contents.
 - c. Manual contents.
2. Title Page: Include the following information:
 - a. Subject matter included in manual.
 - b. Name and address of Project.
 - c. Name and address of Owner.
 - d. Date of submittal.
 - e. Name and contact information for Contractor.
 - f. Name and contact information for Architect.
 - g. Name and contact information for Commissioning Authority.
 - h. Cross-reference to related systems in other operation and maintenance manuals.
3. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
4. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder. Include the following types of information:
 - a. Maintenance instructions
 - b. Copies of warranties.
 - c. Shop drawings and product data.
5. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
 - a. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - 1) Identify each binder on front and spine, with printed title "MAINTENANCE MANUAL," Project title or name, Indicate volume number for multiple-volume sets.
 - b. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 - c. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
6. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

- F. Guarantee: Furnish the Owner with a written guarantee to remedy any defects due to faulty materials or workmanship which appear in the work within two (2) years from date of final acceptance by the Owner.
1. The Contractor warrants to the Owner that materials furnished under the Contract will be of good quality and new, and that the work will be free from defects and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance or improper operation.

1.17 FINAL CLEANING

- A. General: Perform final cleaning prior to substantial completion. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
- a. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - b. Clean exposed interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Including the following:
 - 1) Carpet areas are to be vacuumed.
 - 2) Hard surface floors are free from dry, loose soil, dust, grit/gravel and liter.
 - 3) Hard surface floors are free from black marks, scuffs and scratches.
 - 4) Hard surface floors are free from watermarks, spots, spills and any detergent residues.
 - 5) Walk-off mats are vacuumed and free from liter, dirt, loose soil and gum.
 - 6) Corners, edges and hard to reach areas are free from all the above.
 - 7) Soil that remains after dust mopping of floor and surfaces is removed by wet cleaning.
 - 8) Interior glass doors, sidelites, borrowed lites and transoms are to be free from dust, dirt and hand marks.
 - 9) Exterior glass in windows, doors, sidelites are to be cleaned inside.
 - 10) Light fixtures are cleaned.
 - 11) Exposed pipes and conduit are free from dust and clean.
 - 12) Vents, fire extinguishers, window sills, window ledges and handrails are free from dust, dirt and debris.
 - 13) Casework and countertops are cleaned.
 - 14) Lockers faces are cleaned.
 - c. Remove debris and surface dust from limited access spaces, including plenums, and similar spaces.
 - d. Sweep concrete floors broom clean in unoccupied spaces.
 - e. Leave Project clean and ready for occupancy.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 1000



SUBSTITUTION REQUEST

(After the Bidding Phase)

Project: _____ Substitution Request Number: _____

From: _____
To: _____ Date: _____

A/E Project Number: _____
Re: _____ Contract For: _____

Specification Title: _____ Description: _____
Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
Manufacturer: _____ Address: _____ Phone: _____
Trade Name: _____ Model No.: _____
Installer: _____ Address: _____ Phone: _____
History: ☐ New product ☐ 2-5 years old ☐ 5-10 yrs old ☐ More than 10 years old
Differences between proposed substitution and specified product: _____

☐ Point-by-point comparative data attached - REQUIRED BY A/E

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____
Address: _____ Owner: _____
_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

Savings to Owner for accepting substitution: _____ (\$ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

SUBSTITUTION REQUEST (Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: _____

A/E's REVIEW AND ACTION

- ☐ Substitution approved - Make submittals in accordance with Specification Section 01330.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: _____

Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ _____

SECTION 02 4119 - SELECTIVE DEMOLITION

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 following:
 - 1. Demolition and removal of selected portions of building or structure.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 SUBMITTALS

- A. Predemolition Photographs or Videos: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept wastes.

1.5 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.
- D. Predemolition Conference: Conduct conference at Project site. Review methods and procedures related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.

3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 PROJECT 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. Electronics and associated cabling and accessories
- 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. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- B. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or videos.
 1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
- E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

- A. 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.
 - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 3. Cover and protect furniture, furnishings, and equipment that have not been removed.

3.4 SELECTIVE DEMOLITION, GENERAL

- 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:
- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 POLLUTION CONTROLS

- A. Dust Control: Use temporary enclosures, and other suitable methods to limit spread of dust and dirt.
 - 1. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.
- B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

3.6 PATCHING AND REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by demolition operations.
- B. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
 - 1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.
- C. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- D. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 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.
- B. Burning: Do not burn demolished materials.

3.8 CLEANING

- A. 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 02 4119

SECTION 03 0130 – MAINTENANCE OF CAST-IN-PLACE CONCRETE

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. Patching existing concrete.

1.3 SUBMITTALS

- A. Product Data: Include material descriptions, chemical composition, physical properties, test data, and mixing and application instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.
- B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.
- C. Store cementitious materials off the ground, under cover, and in a dry location.

PART 2 - PRODUCTS

2.1 BONDING AGENTS

- A. Epoxy Bonding Agent: ASTM C 881, Type I and III.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dayton Superior Corporation; Resi-Bond (J-58).
 - b. Euclid Chemical Company; EUCO #352 EPOXY SYSTEM.
 - c. Sika Corporation; Sikadur 31 Hi-Mod Gel.

2.2 PATCHING MORTAR

- A. Cementitious Patching Mortar: Rapid-setting, rapid hardening, packaged, dry mix cementitious material complying with ASTM C 928.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dayton Superior Corporation; Day-Chem Perma-Patch.
 - b. Euclid Chemical Company; EUCO-SPEED.
 - c. Sika Corporation; Sikaset Roadway Patch.

2.3 MIXES

- A. Mix products in clean containers according to manufacturer's written instructions.
 - 1. Add aggregates to products only as recommended by manufacturer.
 - 2. Do not add water, thinners, or additives unless recommended by manufacturer.
 - 3. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.
 - 4. Do not mix more materials than can be used within recommended open time. Discard materials that have begun to set.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Epoxy Bonding Agent: Apply to concrete by brush according to manufacturer's written instructions, leaving no pinholes or other uncoated areas. Apply patching mortar or concrete while epoxy is still tacky. If bonding agent dries, recoat before placing patching mortar or concrete.
- B. Patching Mortar: Unless otherwise recommended by manufacturer, apply as follows:
 - 1. Apply epoxy bonding agent to existing concrete substrate.
 - 2. Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch.
 - 3. After each lift is placed, consolidate material and screed surface.
 - 4. Where multiple lifts are used, score surface of lifts to provide a rough surface for application of subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.
 - 5. Allow surfaces of lifts that are to remain exposed to become firm and then finish to a smooth surface with a wood or sponge float.
 - 6. At slab surfaces, screed patching material to produce a surface that when finished will match required profile and surrounding concrete.
 - 7. Cure patching material for not less than seven days by covering with moisture retaining polyethylene sheet.

END OF SECTION 03 0130

SECTION 04 2000 - UNIT MASONRY ASSEMBLIES

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 unit masonry assemblies consisting of the following:
 - 1. Concrete masonry units (CMUs).
 - 2. Mortar and grout.
 - 3. Masonry joint reinforcement.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops indicated net-area compressive strengths (f'_m) at 28 days.
- B. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
 - 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Joint reinforcement.
- D. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
 - 1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

- A. Stain Prevention: Prevent mortar, from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from mortar splatter by spreading coverings on floor and over wall surface.
- B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit masonry damaged by frost or freezing conditions. Comply with the following requirements:
 - 1. Preparation:
 - a. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.
 - b. Do not lay masonry units having a temperature below 20 degrees F.
 - 2. Cold-Weather Construction: When the ambient temperature is within the limits indicated, use the following procedures. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10 degrees F.
 - a. 40 to 32 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F.
 - b. 32 to 25 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F.

- c. 25 to 20 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F.
- d. 20 deg F and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.2 CONCRETE MASONRY UNITS (CMUs)

- A. Concrete Masonry Units: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
 - 2. Weight Classification: Medium weight or normal weight.
 - 3. Size (Width): Manufactured to the following dimensions:
 - a. Nominal face dimension of 16 inches long x 8 inches high (15-5/8 inches x 7-5/8 inches actual) x 3/8 inch less than nominal widths indicated on Drawings.
 - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color cement.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- D. Masonry Cement: The use of masonry cement, ASTM C 91 or premixed mortars containing masonry cement is not allowed.
- E. Mortar Cement: The use of mortar cement, ASTM C 1329 or premixed mortars containing mortar cement is not allowed.
- F. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- G. Aggregate for Grout: ASTM C 404.
- H. Water: Potable.

2.4 REINFORCEMENT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Joint Reinforcement, Ties, and Anchors:
 - a. Dur-O-Wal, Inc.
 - b. Heckman Building Products, Inc.
 - c. Hohmann & Barnard, Inc.
 - d. Masonry Reinforcing Corp. of America.
 - e. Wire-Bond
- B. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.
- C. Masonry Joint Reinforcement, General: ASTM A 951.
 - 1. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 2. Wire Size for Side and Cross Rods: W1.7 or 0.148-inch (9gage) diameter.
 - 3. Wire Size for Veneer Ties: W1.7 or 0.148-inch (9gage) diameter.
 - 4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 5. Provide in lengths of not less than 10 feet with prefabricated corner and tee units.
- D. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.
 - 1. Basis of Design Products:
 - a. Hohmann & Barnard, Inc. No. 220.
- E. Adjustable Anchors: Provide two-piece assemblies that allow adjustment but resist tension and compression forces perpendicular to plane of wall, field bend to connect intersecting walls.
 - 1. Basis of Design Product:
 - a. Hohmann & Barnard, Inc. "Slip-Set Stabilizer."

2.5 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Limit cementitious materials in mortar to portland cement and lime.
 - a. Do not use mortar cement in mortar or preblended mortars containing mortar cement.
 - b. Do not use masonry cement in mortar or preblended mortars containing masonry cement.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. The proportions shall be measured by means of a box or other container of predetermined capacity. Provide the following types of mortar.
 - 1. Use Type N.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Thickness: Build single wythe walls to full thickness shown.
- B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
- D. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Lay masonry in running bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

3.3 MORTAR BEDDING AND JOINTING

- A. Lay concrete masonry units as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
- B. Lay brick masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.4 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.

3.5 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 3. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.6 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 2000

SECTION 05 5000 - METAL FABRICATIONS

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. Steel framing and supports for floor to ceiling toilet compartments.
 - 2. Bent metal angles supporting ceiling light cove
 - 3. Bent metal restraints at top of interior concrete masonry walls.

1.3 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- B. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- C. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.6 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. 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.

- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 9

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.

- F. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
- C. Fabricate support for suspended toilet partitions as follows:
 - 1. Beams: Continuous steel shapes of size required to limit deflection to L/360 between hanger but use not less than C 8 x 11.5 channels or another shape with equivalent structural properties.
 - 2. Hangers: Steel rods, 1/2 inch in diameter, spaced not more than 36 inches o.c. Thread rods to receive anchor and stop nuts. Fit hangers with wedge shape washers for full bearing on sloping flanges of support beam.
 - 3. Braces and Angles: Steel angles of size required for rigid support of beam and for secure anchorage.

2.7 BENT METAL RESTRAINTS

- A. Bent Metal Restraints: Provide bent metal restraints to restrain top of masonry walls as indicated on Drawings.
 - 1. Fabricate bent metal restraints from 12 gage galvanized sheet steel.
 - 2. Provide bent metal restraints 4 inches long, spaced at 2'-0" o.c., staggered each side of wall.

2.8 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.

2.9 STEEL AND IRON FINISHES

- A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications:
 - 1. SSPC-SP 3, "Power Tool Cleaning."
- B. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

3.2 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 05 5000

SECTION 06 1000 - ROUGH CARPENTRY

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. Wood blocking and nailers.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. SPIB: The Southern Pine Inspection Bureau.

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not allow materials to become damp. Maintain temperature at 60 deg F or higher and humidity between 20 percent and 60 percent prior to, during and after installation.
- B. Protect material against weather and contact with damp or wet surfaces from time of delivery through time of installation. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic and other causes.
- C. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

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, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded 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. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPAC2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPAC31 with inorganic boron (SBX).
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or 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 roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPAC20 (lumber) and AWPAC27 (plywood).
 - 1. Use Exterior type for exterior locations and where indicated.
 - 2. Use Interior Type A, unless otherwise indicated.
- B. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Identify fire-retardant-treated wood and plywood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. Application: Treat items indicated on Drawings, and the following:

1. Concealed blocking.
2. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
 2. Nailers.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content and the following species:
1. Mixed southern pine; SPIB.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that 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 or Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- F. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.6 MISCELLANEOUS MATERIALS

- A. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- C. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- D. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- E. Securely attach rough carpentry work to substrate.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION 06 1000

SECTION 07530 - SINGLE-PLY MEMBRANE ROOFING

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. Modifications to existing thermoplastic single ply membrane roofing system.
 - 2. Roof insulation.
- B. Roofing Terminology: Refer to ASTM D 1079 for definition of terms related to roofing work not otherwise defined in this Section.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet membrane roofing and base flashing that are watertight; will not permit the passage of liquid water; and will withstand wind loads, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.
- C. FM Listing: Provide sheet membrane, base flashings, and component materials that meet requirements of FM 4450 and FM 4470 as part of a roofing system and that are listed in FM's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM markings.
 - 1. Roofing system shall comply with the following:
 - a. Fire/Windstorm Classification: Class 1A-60.
- D. Factory Prefabrication: Field measure roof and factory fabricate sheets of thermoplastic single ply membrane so as that 80 to 85 percent of all seams are factory fabricated in a controlled environment.

1.4 SUBMITTALS

- A. Product Data: For each type of roofing product specified.
- B. Shop Drawings: Include plans, sections, and details of the following:
 - 1. Indicate layout of factory fabricated membrane sheets and field seam locations.
 - 2. Base flashings and membrane terminations.
 - 3. Tapered insulation, including slopes.
- C. Samples: Not required.

- D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system.
- E. Maintenance Data: For roofing system to include in the maintenance manuals.
- F. Warranty: Sample copy of roofing system manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.
- G. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: The existing single-ply membrane roofing system is a Duro-Last system currently under warranty. The roofing installer shall be an experienced installer to perform work of this Section who has specialized in installing roofing similar to that required for this Project and who is approved, authorized, or licensed by the Duro-Last to install manufacturer's product.
- B. Fire-Test Characteristics: Provide roofing materials with the fire-test characteristics indicated as determined per test method indicated below by UL or FM, acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and slopes indicated.
- C. Preinstallation Conference: Before installing roofing system, Contractor will conduct conference at Project site and will notify participants at least 5 working days before conference.
 - 1. Meeting will include Architect; Owner; roofing Installer; roofing system manufacturer's representative.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
 - 4. Review temporary protection of existing roofing systems not being removed.
 - 5. Review temporary protection requirements for roofing system during and after installation.
 - 6. Review roof observation and repair procedures after roofing installation.
 - 7. Contractor will document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid materials from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

- E. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturers' written instructions and warranty requirements.

1. Coordinate roofing work so that building is not exposed to precipitation nor exposed overnight.

1.7 WARRANTY

- A. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Project Warranty: Submit roofing Installer's warranty signed by Installer, covering Work of this Section, including all components of membrane roofing system such as base flashing, roof insulation, fasteners, for the following warranty period:
1. Warranty Period: Two years from date of Substantial Completion.
2. Contact Manufacturer prior to commencement of Work as necessary to preserve current Warranty
- C. Submit written verification signed by Duro-Last stating that the Owner's full system warranty remain in effect after modification of the existing roofing system.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC (PVC) SHEET MEMBRANE

- A. PVC Sheet: Uniform, flexible sheet formed from ultraviolet resistant polyvinyl chloride with Elvaloy KEE , complying with ASTM D 4434, Type III of the following thickness, and exposed face color:
1. Thickness: 50 mils, minimum.
2. Exposed Face Color: White.
3. Physical Properties: Provide PVC thermoplastic sheets with the following properties as determined per ASTM test method indicated:
- a. Breaking Strength: Greater than 200 lbf/in.; ASTM D 751.
- b. Elongation at Break: Greater than 20 percent; ASTM D 751.
- c. Tearing Resistance: Greater than 45 lbs/in; ASTM D 751.
- d. Resistance to Heat Aging: Greater than 90 percent retention of breaking strength and 90 percent elongation; ASTM D 751.
- e. Low-Temperature Bend: Pass at minus 40 deg F; ASTM D 2136.
- f. Accelerated Weathering Test: No cracking or crazing; ASTM D 2565.
- g. Linear Dimension Change: Less than 0.5 percent maximum; ASTM D 1204.
- h. Water Absorption: Less than 3 percent mass change; ASTM D 570.
4. Manufacturers:
- a. "Duro-Last Roofing, Inc.

2.2 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing material.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, thickness, and color as sheet membrane.

- C. Bonding Adhesive: Manufacturer's standard bonding adhesive.
- D. Metal Termination Bars: Manufacturer's standard aluminum bars, approximately 1 inch wide, roll formed and prepunched.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions of FM 4470, designed for fastening sheet to substrate, and acceptable to roofing system manufacturer.
- F. Pipe Penetration Flashing: Provide single-ply roofing manufacturer's standard pre-molded or prefabricated vent stack boots sized to fit pipe and conduit diameter. Provide complete with stainless steel drawband.
 - 1. Pre-molded boots shall be fabricated of manufacturer's standard membrane with outside base welding edge and inside base and tapered cylinder.
 - 2. Pre-fabricated boots shall be fabricated from reinforced membrane with welding edge and cylinder both same thickness.
- G. Draw Band: Stainless steel type as recommended by single-ply roofing manufacturer for banding and securing all pre-molded or pre-fabricated of field fabricated boots.
- H. Membrane Coated Metal for Thermoplastic Membranes: Provide 24 gage hot-dipped galvanized steel, ASTM A 361, G-90, coated one side with single-ply roofing manufacturer's standard membrane.
- I. Sealant: Single component, non-sag urethane complying with ASTM C 920, Type S, Grade NS, Class 25.
- J. Miscellaneous Accessories: Provide pourable sealers, preformed inside and outside corner sheet flashings, seam calk, and other accessories recommended by roofing system manufacturer for intended use.
- K. Wood Blocking: Refer to Section 06100 "Rough Carpentry."
- L. Fasteners: Provide fasteners with hot-dip zinc coating complying with ASTM A 153.

2.3 INSULATION MATERIALS

- A. General: Provide preformed roof insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thicknesses indicated.
 - 1. Provide preformed, tapered polyisocyanurate insulation boards where indicated for sloping to drain. Fabricate with the tapers as indicated on Drawings:
 - 2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
 - 3. Fabricate tapered insulation to provide 1/4" per foot slope to drains.
- B. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation with core formed by using HCFCs as blowing agents to comply with ASTM C 1289, classified by facer type as follows:
 - 1. Facer Type: Type II, felt or glass-fiber mat on both major surfaces.
 - 2. Thickness: Two layers of 1-1/2 inches for a total thickness of 3 inches below tapered insulation.

2.4 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with sheet roofing material.

- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions of FM 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. General: Coordinate removal of existing roofing and installation of new roofing so that building is not exposed to precipitation nor exposed overnight.
 - 1. Provide membrane manufacturer's standard night seal cutoff material to temporarily seal membrane.
- B. During removal of existing roofing and installation of new roofing, building must remain in operation. Do not block driveways, walks, fire access routes or pedestrian entrances.
- C. Protect building and grounds from damage during removal of existing roofing and installation of new roofing.
 - 1. Where removal of existing roofing and installation of new roofing requires transversing existing roofing to remain, provide temporary protection of existing roofing consisting of minimum of 1/2 inch thick plywood sheets set on minimum 1 inch thick insulation, ballasted by sand bags. Leave temporary roof protection in place until roofing work is complete, but remove before final inspection.
 - 2. Repair any damage caused by roofing operations to satisfaction of Owner without any cost to Owner.
 - 3. Provide drop chutes and other temporary protection as required to contain roofing materials being removed.
 - 4. Confine removal operations to areas directed by Owner's Representative.
 - 5. Provide trucks or dumpsters to contain debris.

3.2 PREPARATION

- A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of the roofing system and building at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 SINGLE-PLY MEMBRANE SEAM INSTALLATION

- A. Clean seam areas, overlap sheets, and weld side and end laps of sheets and flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. Thermoplastic membrane surfaces must be cleaned with diluted organic detergent (Spic & Span, 409, etc.) or isopropyl alcohol or acetone and wiped with clean, dry cloth.
- B. Thermoplastic Membrane Seam Method: Hot air weld.
- C. Test lap edges with probe to verify seam weld continuity. Apply seam caulk to seal cut edges of sheet membrane.
- D. Repair tears, voids, and lapped seams in roofing that does not meet requirements.

- E. Install sheet flashings and preformed flashing accessories and adhere to substrate according to thermoplastic roofing system manufacturer's written instructions.
- F. Apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- G. Flash penetrations and field-formed inside and outside corners with sheet flashing as recommended by manufacturer.
 - 1. Round all exposed corners of roofing membrane at all junction laps, at all flashings and at all end laps prior to hot-air welding.
- H. Thermoplastic Membrane Flashings: After seam areas have been cleaned, overlap sheets, and firmly roll flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
 - 1. Weld Method: Hot air.
 - 2. Provide a minimum of 1" wide continuous weld for each seam. Weld must start at exposed edge of membrane.
 - 3. All field fabrications shall be uniform and consistent with manufacturer's recommendations.
 - 4. Distance of hot-air welded laps in relation to mechanical attachments shall be no greater than 4" maximum.
 - 5. All end laps shall be mechanically fastened with fasteners and plates with the same interval spacing as in the field sheets.
- I. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.
- J. All field fabrications shall be uniform and consistent with manufacturer's recommendations.

3.4 FIELD QUALITY CONTROL

- A. Test seams daily, according to manufacturer's written instructions, and repair seam defective seam areas.
- B. Completed roofing shall contain no wrinkles of such size as to restrict roof drainage.
 - 1. All wrinkles which restrict drainage shall be cut out and replaced with new membrane.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Construction Manager and Architect.
 - 1. Notify Architect 48 hours in advance of the date and time of inspection.
- D. Correct deficiencies in or remove roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair sheet flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.
- E. Clean spillage from adjacent construction using cleaning agents and procedures required by manufacturer of affected construction.

END OF SECTION 07 5300

SECTION 07 8413 - FIRESTOP 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:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke barriers.
- B. Related Sections include the following:
 - 1. Division 21, 22 and 23 Sections specifying duct and piping penetrations.
 - 2. Division 26, 27 and 28 Sections specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-rated constructions, including both empty openings and openings containing penetrating items, provide firestop systems to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-rating of construction penetrated.
 - 1. Fire-rated walls including fire walls, fire partitions, fire barriers and smoke barriers.
 - 2. Fire-rated horizontal assemblies.
- B. Rated Systems: Provide firestop systems with the following ratings determined per ASTM E 814:
 - 1. F-Rated Systems: Provide firestop systems with F-ratings not less than that equaling or exceeding fire-rating of constructions penetrated.
 - 2. T-Rated Systems: Provide firestop systems with T-ratings, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-rated shaft enclosures.
 - 3. L-Rated Systems: Where firestop systems are indicated in smoke barriers, provide firestop systems with L-ratings of not more than 3.0 cfm/sq. ft at both ambient temperatures and 400 deg F.

- C. For firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - 3. For penetrations involving insulated piping, provide firestop systems not requiring removal of insulation.
- D. For firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each firestop system, show each type of construction penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each firestop system configuration for construction and penetrating items.
 - 2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular firestop condition, submit illustration, with modifications marked, approved by firestop system manufacturer's fire-protection engineer as an engineering judgment for equivalent fire-rated assembly.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing firestop systems similar in material, design, and extent to that indicated for this Project. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements.
- B. Fire-Test Characteristics: Provide firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, OPL, or ITS, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
 - a. Firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Firestop systems correspond to those indicated by reference to firestop system designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) OPL in its "Directory of Listed Building Products, Materials, & Assemblies."
 - 3) ITS in its "Directory of Listed Products."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install firestop systems when ambient or substrate temperatures are outside limits permitted by firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate firestop systems.
- C. Do not cover up firestop system installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide firestop systems that are produced by one of the following manufacturers:
 - 1. Hilti, Inc.
 - 2. Johns Manville.
 - 3. RectorSeal Corporation (The).
 - 4. Specified Technologies Inc.
 - 5. 3M; Fire Protection Products Division.
 - 6. Tremco; Sealant/Weatherproofing Division.

2.2 FIRESTOPPING, GENERAL

- A. VOC Content: Provide firestopping that complies with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) to meet LEED requirements:
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.

- B. Compatibility: Provide firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating firestop systems.
- C. Accessories: Provide components for each firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.
 - 6. Steel retaining clips.

2.3 FILL MATERIALS

- A. General: Provide firestop systems containing the types of fill materials indicated. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.
- B. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
 - 1. Do not use sealants that are white in color, as authorities having jurisdiction are unsure if sealants are approved firestopping or non-rated type.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

- I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
 2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
 3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.
 4. Do not use sealants that are white in color, as authorities having jurisdiction are unsure if sealants are approved firestopping or non-rated type.

2.4 MIXING

- A. For those products requiring mixing before application, comply with firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of firestop systems.
 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestop systems. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 FIRESTOP SYSTEM INSTALLATION

- A. General: Install firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

- B. Install forming/damming/backing 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 firestop systems.
- C. Install fill materials for firestop systems 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 Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.5 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. 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.

F. 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.

G. Firestop Systems for Miscellaneous Mechanical Penetrants:

1. Type of Fill Materials: One or both of the following:
 - a. Latex sealant.
 - b. Mortar.

H. 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.

I. Firestop Systems for Head of Wall:

1. Type of Fill Materials: One of the following:
 - a. Latex sealant.
 - b. Spray coatings for head of wall.

END OF SECTION 07 8413

SECTION 07 9200 - JOINT SEALANTS

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 joint sealants for the following applications, including those specified by reference to this Section:
 - 1. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Perimeter joints of interior door frames.
 - b. Vertical joints on exposed surfaces of interior unit masonry, concrete walls and partitions.
 - c. Other joints as indicated.
- B. Related Sections include the following:
 - 1. Section 04 2000 "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
 - 2. Section 07 8413 "Firestopping Systems" for sealing joints in fire-rated construction.
 - 3. Section 09 2900 "Gypsum Board" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.6 FIELD 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 or are below 40 deg F.
 - 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.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, 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 joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
- C. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
 1. Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.

2.2 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolac.
 - b. May National Associates, Inc.; Bondaflex 600 or Bondaflex Sil-A 700.
 - c. Pecora Corporation; AC-20+.
 - d. Tremco Incorporated; Tremflex 834.

2.3 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and 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) or Type B (bicellular material with a surface skin), 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. Provide self-adhesive tape where applicable.

2.4 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 performance of the Work.
 - 1. Verify that joints in masonry are not bridged by mortar.
- 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, 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. Glass.
 - c. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by 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 or primer 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. Install sealant backings of kind 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.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. 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.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs 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 profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Interior Joints:

1. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces:

a. Joint Sealant: Latex sealant.

b. Locations:

- 1) Perimeter joints of interior door frames.
- 2) Vertical joints on exposed surfaces of interior unit masonry, concrete walls and partitions.
- 3) Other joints as indicated.

END OF SECTION 07 9200

SECTION 08 1113 – HOLLOW METAL DOORS AND FRAMES

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. Hollow-metal steel frames.
- B. Related Sections include the following:
 - 1. Section 04 2000 "Unit Masonry Assemblies" for building anchors into and grouting steel frames in masonry construction.
 - 2. Section 09 9100 "Painting" for field painting hollow metal frames.
 - 3. Door Schedule on Drawings.

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 and temperature-rise ratings, for each type of hollow metal door and frame specified.
- B. Shop Drawings: In addition to requirements below, provide a schedule of hollow metal frames using same reference numbers for details and openings as those on Drawings:
 - 1. Frame details for each frame type, including dimensioned profiles.
 - 2. Details of wall opening condition.
 - 3. Details of anchorages, accessories, joints, and connections.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal frames through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs.
- C. Store 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 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 hollow metal 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 masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ceco Door Products; an ASSA ABLOY Group Company.
 2. CURRIES Company; an ASSA ABLOY Group Company.
 3. Pioneer Industries, Inc.
 4. Steelcraft; an Allegion Company.

2.2 MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
 1. 37.9 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153, Class B.
- D. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153.
- E. Grout:
 1. Comply with Section 04 2000 "Unit Masonry Assemblies" for cement grout for frames in masonry walls.
- F. 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 HOLLOW METAL 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 and seamless face joints.
 2. Fabricate frames as face welded.

3. Frames for Cased Openings: 0.053-inch (16 gage) thick steel sheet.

C. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick (18 gage), 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 (7 gage).

D. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick (18 gage), and as follows:

1. Clip-type anchors, with two holes to receive fasteners.

2.4 FABRICATION

A. General: Fabricate hollow metal 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.

B. Hollow Metal Frames:

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
3. 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) Three anchors per jamb from 60 to 90 inches in height.

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 hollow metal frames after assembly.

B. Steel Surface Preparation: Clean steel surfaces to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust. After cleaning, chemically treat steel surfaces to insure maximum adhesion of prime coating to be applied over it.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of hollow metal frames.
 - 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of hollow metal 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.

3.3 INSTALLATION

- A. General: Provide frames of sizes, thicknesses, and designs indicated. Install hollow metal frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames for cased 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. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - b. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - c. Apply bituminous coating to backs of non-fire-rated frames that are filled with mortar and grout. Do not apply bituminous coating to fire-rated frames.
 - 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 Section 04 2000 "Unit Masonry Assemblies".

4. Installation Tolerances: Adjust hollow metal 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: Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal frames that are warped, bowed, or otherwise unacceptable.
- B. Clean grout and other bonding material off hollow metal 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 08 1113

SECTION 08 3113 - ACCESS DOORS

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. Access doors and frames for interior walls and ceilings.
 - 2. Related hardware and attachments
- B. Related Sections include the following:
 - 1. Section 09 2900 "Gypsum Board Assemblies" for anchoring access door frames set in gypsum board assembly construction.

1.3 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain access door(s) and frame(s) through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer.
- B. Store materials inside, under cover, aboveground, and kept dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

- A. Steel Sheet: Uncoated or electrolytic zinc-coated, ASTM A 591 with cold-rolled steel sheet substrate complying with ASTM A 1008, Commercial Steel (CS), exposed.

- B. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - 2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
- 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.
- D. For Fire Rated Access Doors and Frames in Ceilings and Walls specified in Sections 22, 23, 26, provide manufacturer's standard finish from manufacturer's full range of colors, with the intent to match surrounding material finish.

2.2 ACCESS DOORS AND FRAMES FOR INTERIOR CEILINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acudor Products, Inc.
 - 2. Babcock-Davis.
 - 3. Cendrex Inc.
 - 4. Elmdor/Stoneman Manufacturing Co.; Div. of Acorn Engineering Co.
 - 5. Jensen Industries; Div. of Broan-Nutone, LLC.
 - 6. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 - 7. Karp Associates, Inc.
 - 8. Larsen's Manufacturing Company.
 - 9. MIFAB, Inc.
 - 10. Milcor Inc.
 - 11. Nystrom, Inc.
 - 12. Williams Bros. Corporation of America (The).
- B. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.060-inch- thick sheet metal, set flush with exposed face flange of frame.
 - 3. Frame: Minimum 0.060-inch thick sheet metal with 1-inch wide, surface-mounted trim.
 - 4. Hinges: Spring-loaded, concealed-pin type.
 - 5. Latch: Cam latch operated by screwdriver with interior release.

2.3 FABRICATION

- A. General: Provide access door and frame 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. Access 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. Provide mounting holes in frames for attachment of units to metal framing.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces.

3.2 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 08 3113

SECTION 08 8000 – GLAZING

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 glazing for the following products and applications:
 - 1. Laminated Glazing to be reglazed into existing exterior storefront framing

1.3 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
- D. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of the following products; 12 inches square.
 - 1. Laminated Glazing Unit with each color of interlayer indicated
- C. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
- D. Qualification Data: For installers.
- E. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).
- B. **Source Limitations for Glass:** Obtain the following through one source from a single manufacturer for each glass type: clear float glass, coated float glass, laminated glass.
- C. **Source Limitations for Glazing Accessories:** Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- D. **Safety Glazing Products:** Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.
 - 1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
 - 2. Where glazing units, including fully tempered (Kind FT) glass and laminated glass, are specified in Part 2 articles for glazing lites provide glazing products that comply with Category II materials required by 16 CFR 1201 and regulations of authorities having jurisdiction.
- E. **Glazing Publications:** Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. **GANA Publications:** GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
- F. **Safety Glazing Labeling:** Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.7 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.8 WARRANTY

- A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS

- A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
 2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where specified.
 3. For uncoated glass, comply with requirements for Condition A.
 4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
 5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated or required by code.

2.2 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: As indicated.
- B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

2.3 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
1. Neoprene, ASTM C 864.
 2. EPDM, ASTM C 864.
 3. Silicone, ASTM C 1115.
 4. Thermoplastic polyolefin rubber, ASTM C 1115.
 5. Any material indicated above.

- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

2.4 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: Black.

2.5 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
1. Type 1, for glazing applications in which tape acts as the primary sealant.
 2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.6 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.7 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.8 LAMINATED-GLASS UNITS

- A. Clear Laminated-Glass Units: Provide clear laminated safety glass in all non-fire rated doors, sidelights, borrowed lights.
 - 1. Kind LA, consisting of two lites of annealed float glass
 - 2. Kind LT, laminated-tempered, where at slab edge overlooking occupied spaces
 - 3. Outer Lite: Class 1 (clear) float glass.
 - a. Thickness: 3.0 mm.
 - 4. Plastic Interlayer:
 - a. Thickness: 0.060 inch, but not less than that required to comply as a Type II safety glass material.
 - b. Interlayer Color:
 - 1) Type 1 (Lower Lite): White translucent for visual privacy
 - 2) Type 2 (Opaque Spandrel): White/off-white to match finish of adjacent laminated insulated metal infill panels glazed into storefront framing
 - 5. Inner Lite: Class 1 (clear) float glass.
 - a. Thickness: 3.0 mm.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- C. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- D. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- E. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- F. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- G. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- H. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- I. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.

- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- C. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 WASTE MANAGEMENT

- A. Separate and recycle waste materials, packaging, and all other materials in accordance with the Waste Management Plan and to the maximum extent possible, send to reuse or recycle centers.
- B. Close and tightly seal all partly used containers and store protected in well-ventilated, fire-safe area at moderate temperature. Deliver to reuse and/or recycle facilities if not removed from site for Contractor's reuse.

END OF SECTION 08 8000

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

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. Suspension systems for interior ceilings and soffits.
- B. Related Requirements:
 - 1. Section 06 1000 "Rough Carpentry" for wood framing and furring.
 - 2. Section 09 2900 "Gypsum Board" for gypsum board.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
 - 1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory" or GA-600, "Fire Resistance Design Manual."

2.2 FRAMING SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Clark Dietrich Building Systems.
 - 2. Jamies Industries, Inc.
 - 3. MarinoWare.
 - 4. MBA Building Supplies, Inc.
 - 5. Scafco Corporation.
 - 6. State Building Products, Inc.
 - 7. The Steel Network Inc.
- B. 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: ASTM A 653, G40, hot-dip galvanized or coating with equivalent corrosion resistance of ASTM A 653, G40.
3. Studs and Runners: ASTM C 645. Use either steel studs and runners or embossed steel studs and runners.
4. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.0329 inch (20 gage).
 - b. Depth: As indicated on Drawings.
5. Embossed Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness 0.0190 inch (20 gage equivalent).
 - b. Depth: As indicated on Drawings.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Wire Hangers: ASTM A 641, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (16 gage) and minimum 1/2-inch-wide flanges.
 1. Depth: 1-1/2 inches, unless otherwise indicated on Drawings.
- D. Furring Channels (Furring Members):
 1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base-Metal Thickness: 0.0296 inch (22 gage).
- E. Grid Suspension System for Interior Ceilings (Contractor's Option): ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock. Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized according to ASTM A 653, not less than G40 coating designation; with not less than 1-3/8-inch wide with dimpled metal caps on flanges.
 1. Structural Classification: Heavy-duty system.
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
 - b. Chicago Metallic Corporation; Drywall Furring 640 or Drywall Furring 660 System.
 - c. USG Interiors, Inc.; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following:
 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

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 of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Hangers: 48 inches o.c.
 - 2. Carrying Channels (Main Runners): 48 inches o.c.
 - 3. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend 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 suspension system.
 - a. 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.

- a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
- 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
- 4. Do not attach hangers directly to steel roof deck.
- 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
- 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
- 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 2216

SECTION 09 2900 - GYPSUM BOARD ASSEMBLIES

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. Interior gypsum board.
 - 2. Tile backing panels.
- B. Related Requirements:
 - 1. Section 09 2216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.
- C. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.4 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 weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
 - 1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory" or "GA-600, "Fire Resistance Design Manual."
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
 - 1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Impact-Resistant Gypsum Board: ASTM C 1396.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; AirRenew Extreme Impact Type X Gypsum Board.
 - b. Continental Building Products LLC.; Protecta HIR 300 Type X with Mold Defense Impact Resistant Panels.
 - c. Georgia-Pacific Gypsum; DensArmor Plus Impact Resistant Interior Gypsum Board.
 - d. National Gypsum Company; Gold Bond Hi-Impact Brand XP Gypsum Board.
 - e. United States Gypsum Co.; Sheetrock Mold Tough VHI Firecode Panels.
 - 2. Core 5/8 inch, Type X.
 - 3. Long Edges: Tapered.
- B. Glass-Mat, Water-Resistant Tile Backing Board: ASTM C 1178.
 - 1. Core: 1/4 inch, 1/2 inch and 5/8 inch, where indicated.
 - 2. Product: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed; "Diamondback Glassroc Tile Backer Type X"
 - b. G-P Gypsum Corp.; "DensShield Tile Backer".
 - c. National Gypsum Company; "Gold Bond e²XP Tile Backer".
 - d. United States Gypsum Co.; "Fiberock Aqua-Tough Tile Backerboard"

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.

- c. Expansion (control) joint.
- 3. Corner Beads for Inside and Outside Corners: Structural laminate corner bead system consisting of tapered copolymer core, joint tape and formulated surface paper. Corner beads will withstand severe impacts.
 - a. Product/Manufacturer: Provide the following:
 - 1) "Ultraflex and Ultratrim No-Coat Structural Laminate Drywall Corner System; CertainTeed (formerly Structus Building Technologies; (888) 662-6281)

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- 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.
- C. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - 2. Thickness: 3 inches, unless otherwise indicated.
- D. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Company; SHEETROCK Acoustical Sealant.

- E. Neoprene Closure Strips: ASTM D 1056, Grade SCE41 and RE41E1, black, closed-cell neoprene, 1/2" thick.

- 1. Products: Williams Neoprene Type NN1, 1040 Series, Williams Products, Inc. (248) 643-6400.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in 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 gypsum board 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. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum 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 gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.

2. On partitions/walls, apply gypsum panels vertically (parallel 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.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 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. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. LC-Bead: Use at exposed panel edges.
- C. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
 1. Spackle, patch and repair existing gypsum board walls after removal of existing wall mounted equipment and wall coverings.
- D. Prefill open joints and damaged surface areas.
- E. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- F. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09 9100 "Painting."
- G. Glass-Mat, Water-Resistant Tile Backing Panels: Finish according to manufacturer's written instructions.

3.5 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 2900

SECTION 09 3000 - TILING

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. Wall tile.
 - 2. Floor tile.
 - 3. Stone thresholds.
 - 4. Waterproof/crack-suppression membrane.
 - 5. Metal edge strips installed as part of tile installations.
- B. Related Sections include the following:
 - 1. Room Finish Schedule on Drawings.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: 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. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. 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. Metal edge strips in 6-inch lengths.
 - 5. Stone thresholds in 6-inch lengths.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of each type of wall tile installation.
 - 2. Build mockup of each type of floor tile installation.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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 materials in unopened containers and protected from freezing.

1.7 FIELD 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 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials from single manufacturer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
 - 1. Metal edge strips.
 - 2. Waterproof/crack-suppression membrane.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, 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. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.3 TILE PRODUCTS

- A. Floor Tile: Flat tile as follows:
 - 1. Products: Color Blox; Crossville Porcelain Stone.
 - 2. Composition: Porcelain.
 - 3. Face Size: 6 by 6 inches.
 - 4. Thickness: 3/8 inch.
 - 5. Face: Plain with square or cushion edges.
 - 6. Finish: Cross-sheen.
 - 7. Tile Colors: As indicated in Room Finish Schedule on Drawings
- B. Wall Tile: Mosaic tile as follows:
 - 1. Product: Color Blox Mosaics; Crossville Porcelain Stone.
 - 2. Composition: Porcelain.
 - 3. Module Size: 3 by 3 inches.
 - 4. Thickness: 1/4 inch.
 - 5. Mounting: Factory, back mounted.
 - 6. Face: Plain with cushion edges.
 - 7. Finish: Smooth, without abrasive admixture.
 - 8. Tile Colors: As indicated in Room Finish Schedule on Drawings
- C. Wall Tile: Porcelain tile as follows:
 - 1. Product: Color Blox; Crossville Porcelain Stone.
 - 2. Composition: Porcelain.
 - 3. Module Size: Custom size, 6 by 24 inches.
 - 4. Thickness: 3/8 inch.
 - 5. Face: Plain with cushion edges.
 - 6. Finish: Smooth, without abrasive admixture.
 - 7. Tile Colors: As indicated in Room Finish Schedule on Drawings

- D. 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. Base: Cove Base.
 - a. Product: Color Blox; Crossville Porcelain Stone.
 - b. Composition: Porcelain.
 - c. Face Size: 6 by 12 inches.
 - d. Thickness: 3/8 inch.
 - e. Face: Plain with square or cushion edges.
 - f. Finish: Cross-sheen.
 - g. Tile Colors: As indicated in Room Finish Schedule on Drawings
2. External Corners for Thin-Set Mortar Installations: Metal edge trim.
3. Internal Corners: Field-buttet square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.

2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch or less, and finish bevel to match face of threshold.
- B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 12 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.
1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.5 WATERPROOFING/CRACK SUPPRESSION MEMBRANES FOR THIN-SET TILE INSTALLATIONS

- A. General: Manufacturer's standard product that complies with ANSI A118.10, selected from the following.
- B. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber and fabric reinforcement.
1. Products:
 - a. Bostik; Black-Top 90210; Waterproofing and Anti-Fracture Membrane.
 - b. Bostik; Hydroment Gold Waterproofing and Anti-Fracture Membrane.
 - c. Custom Building Products; Custom 9240 Waterproofing and Anti-Fracture Membrane.
 - d. Mapei Corp.; Mapelastic AquaDefense Waterproofing/Crack Isolation Membrane.
 - e. Mapei Corp.; Mapelastic HPG Waterproofing/Crack Isolation Membrane
 - f. TEC Specialty Products, Inc.; Hydraflex Waterproofing Crack Isolation Membrane.
- C. Unreinforced, Fluid-Applied Product: Self-curing liquid rubber polymer in a consistency suitable for brush or roller application and intended for use as waterproofing/anti-fracture membrane.
1. Products:
 - a. Custom Building Products; RedGard Waterproofing and Crack Prevention Membrane.
 - b. LATICRETE International Inc.; Laticrete Hydroban Waterproofing/Anti-Fracture Membrane.

2.6 SETTING MATERIALS

- A. Latex-Portland Cement Mortar (Thinset): ANSI A118.4.
 - 1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
 - a. Products:
 - 1) Bostik; Hydroment Single Flex Premium Multi-Purpose Latex Modified Thin Set Mortar.
 - 2) Custom Building Products; FlexBond Fortified Thin Set Mortar.
 - 3) Laticrete International Inc.; Laticrete 254 Platinum Multipurpose Thin-Set Mortar.
 - 4) Mapei Corp.; Ultraflex 3 Polymer Modified Thin Set Mortar.
 - 5) TEC Specialty Products; Full Flex Latex Modified Thin Set Mortar.

2.7 GROUT MATERIALS

- A. Water-Cleanable Epoxies (ANSI A118.3):
 - 1. Products:
 - a. Bostik; Hydroment Ez-Poxy EzClean Setting and Grouting System.
 - b. Custom Building Products; 100 Percent Solids Epoxy Grout Admix for Classic-Blend Sanded Grout.
 - c. Laticrete International Inc.; SpectraLock Pro Grout.
 - d. Mapei Corp.; Opticolor Stain Free Grout.
 - e. TEC Specialty Products; Accucolor EFX Epoxy Grout.
- B. VOC content not to exceed 50 g/L

2.8 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, satin nickel anodized aluminum.
 - 1. Products: Jolly; Schluter Systems L.P
- C. Tile Cleaner: A neutral 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.
- D. VOC content not to exceed 200 g/L

2.9 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 A108.13 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 has been completed before installing tile.
 - 3. 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 existing terrazzo 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. Grind existing terrazzo floors to remove all dirt, grime and sealers.
- 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.

3.3 INSTALLATION, GENERAL

- A. 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.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. 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.

- D. 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.
- E. 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.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Expansion Joints: Locate expansion joints and other sealant-filled 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.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- H. Grout tile to comply with requirements of the following tile installation standards:
 - 1. For epoxy grouts, comply with ANSI A108.6.
- I. At showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 WATERPROOFING/CRACK-SUPPRESSION MEMBRANE INSTALLATION

- A. Install waterproofing/crack suppression membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
- B. Do not install tile over waterproofing/crack suppression until membrane has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE INSTALLATION

- A. 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.
- B. Joint Widths: Install tile on floors with the following joint widths:
 - 1. Porcelain Mosaic Tile: 1/8 inch.
- C. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.
 - 1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.
- D. Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

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. Install metal lath and scratch coat for walls to comply with ANSI A108.1A, Section 4.1.
- C. Joint Widths: Install tile on walls with the following joint widths:
 - 1. Porcelain Mosaic Tile: 1/8 inch.
 - 2. Glazed Wall Tile: 3/16 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 latex-portland cement mortar and epoxy grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use 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. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.8 FLOOR TILE INSTALLATION SCHEDULE

- A. Tile Installation: Interior floor installation on waterproof/crack-suppression membrane over concrete (cementitious terrazzo) ; thin-set mortar; TCA F122 and ANSI A108.5.
 - 1. Tile Type: As indicated in Room Finish Schedule on Drawings.
 - 2. Thin-Set Mortar: Latex-portland cement mortar.
 - 3. Grout: Epoxy grout.

3.9 WALL TILE INSTALLATION SCHEDULE

- A. Tile Installation: Interior wall installation over sound, dimensionally stable masonry or concrete; thin-set mortar; TCA W202 and ANSI A108.5.
 - 1. Tile Type: As indicated in Room Finish Schedule on Drawings.
 - 2. Thin-Set Mortar: Latex-portland cement mortar.
 - 3. Grout: Epoxy grout.

- B. Tile Installation: Interior wall installation over glass-mat, water-resistant backer board; thin-set mortar; TCA W245 and ANSI A108.5.
1. Tile Type: As indicated in Room Finish Schedule on Drawings.
 2. Thin-Set Mortar: Latex-portland cement mortar.
 3. Grout: Epoxy grout.

END OF SECTION 09 3000

SECTION 09 9100 - PAINTING

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 surface preparation and field painting of the following:
 - 1. Exposed interior items and surfaces.
 - 2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select colors and finishes. Painting includes but is not limited to the following:
 - 1. Painting of all semi-concealed areas (e.g. inside of light troughs and valances, behind grilles, above floating ceilings, and projecting edges above and below sight lines.
 - 2. Interior substrates include the following:
 - a. Steel.
 - b. Gypsum board.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Prefinished items include the following factory-finished components:
 - a. Toilet enclosures.
 - b. Finished mechanical and electrical equipment.
 - c. Light fixtures.
 - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Furred areas.
 - b. Ceiling plenums.
 - c. Pipe spaces.
 - 3. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper and copper alloys.
 - e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Section 08 1113 "Hollow Metal Doors and Frames" for factory priming hollow metal doors and frames.
2. Section 09 2900 "Gypsum Board Assemblies" for surface preparation of gypsum board.
3. Room Finish Schedule on Drawings.

1.3 DEFINITIONS

- A. Dry Film Thickness (DFT): The thickness of the dry film of a coating measured in mils.
- B. Mils: One one-thousandth of an inch. Used to measure thickness of coating films.
- C. Sheen/Gloss: Defined in ASTM D 523 apply to this Section.
 1. Gloss Level 1 (Matte or Flat Finish): Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
 2. Gloss Level 2 (Velvet Finish): Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
 3. Gloss Level 3 (Eggshell Finish): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
 4. Gloss Level 4 (Satin Finish): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
 5. Gloss Level 5 (Semi-Gloss Finish): 35 to 70 units at 60 degrees, according to ASTM D 523.
 6. Gloss Level 6 (Gloss Finish): 70 to 85 units at 60 degrees, according to ASTM D 523.
 7. Gloss Level 7 (High Gloss Finish): More than 85 units at 60 degrees, according to ASTM D 523.
- D. Product Data: For each type of product. Include preparation requirements and application instructions, include the following:
 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. VOC content.
- E. Samples for Verification: For each color and material to be applied.
 1. On draw down display cards submit three samples of each color and finish.
- F. Maintenance Data: Submit the following:
 1. Color Chips: After final approval of all colors, submit color chips of all coatings used with manufacturer's name and mix formulation of each color and coating for the purpose of future re-ordering of coatings. Color chips shall be at least six (6) inches square.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm and individuals experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project.
 - 1. Only qualified journeypersons, as defined by local jurisdiction, shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyperson in accordance with trade regulations.
- B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in 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. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. VOC content.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Protect from freezing. Keep storage area neat and orderly.
 - 3. Remove rags and waste from storage areas daily.
- C. Take all necessary precautionary and safety measures to prevent fire hazards and spontaneous combustion and to protect the environment from hazard spills. Materials that constitute a fire hazard (paints, solvents, drop clothes, etc.) shall be stored in suitable closed and rated containers and removed from the site on a daily basis.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.
- C. Apply paint only to dry, clean, and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
- B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Benjamin Moore & Co. (Benjamin Moore).
 - 2. PPG Industries, Inc. (Pittsburgh Paints).
 - 3. Sherwin-Williams Co. (Sherwin-Williams).

2.2 PAINT MATERIALS, 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.
 - 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.
- B. All paint shall be ready-mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity.
- C. Material Quality: Provide manufacturer's paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other specified manufacturers.
- D. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Dry-Fog Coatings: 400 g/L.
 - 4. Primers, Sealers, and Undercoaters: 200 g/L.
 - 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 - 7. Pretreatment Wash Primers: 420 g/L.
 - 8. Floor Coatings: 100 g/L.
 - 9. Shellacs, Clear: 730 g/L.
 - 10. Shellacs, Pigmented: 550 g/L.
- E. Low-Emitting Materials: Interior paints and coatings 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."

F. Restricted Components: Paints and coatings shall not contain any of the following:

1. Acrolein.
2. Acrylonitrile.
3. Antimony.
4. Benzene.
5. Butyl benzyl phthalate.
6. Cadmium.
7. Di (2-ethylhexyl) phthalate.
8. Di-n-butyl phthalate.
9. Di-n-octyl phthalate.
10. 1,2-dichlorobenzene.
11. Diethyl phthalate.
12. Dimethyl phthalate.
13. Ethylbenzene.
14. Formaldehyde.
15. Hexavalent chromium.
16. Isophorone.
17. Lead.
18. Mercury.
19. Methyl ethyl ketone.
20. Methyl isobutyl ketone.
21. Methylene chloride.
22. Naphthalene.
23. Toluene (methylbenzene).
24. 1,1,1-trichloroethane.
25. Vinyl chloride.

G. Colors: As indicated in Room Finish Schedule on Drawings.

1. Where the Room Finish Schedule calls for deep tones (interior and exterior) it is the responsibility of the painting contractor to utilize the appropriate deep tone primers for use on the substrate for which they are intended.

2.3 INTERIOR PRIMERS

A. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

1. Benjamin Moore; Ultra Spec 500 Interior Latex Primer No. N534 (0 g/L VOC): Applied at a dry film thickness of not less than 0.8 mils.
2. Pittsburgh Paints; 6-4900 Speedhide zero Interior Zero VOC Latex Sealer (0 g/L VOC): Applied at a dry film thickness of not less than 1.4 mils.
3. Sherwin-Williams; S-W ProMar 200 Zero VOC Interior Latex Primer B28 W02600 (0 g/L VOC): Applied at a dry film thickness of not less than 1.5 mils.

B. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive acrylic metal primer.

1. Benjamin Moore; Moore's Super Spec HP Acrylic Metal Primer No. P04 (54g/L VOC): Applied at a dry film thickness of not less than 2.0 mils.
2. Pittsburgh Paints; 90-909 Pitt-Tech Plus Interior/Exterior Industrial DTM Primer (90 g/L VOC): Applied at a dry film thickness of not less than 2.0 mils.
3. Sherwin-Williams; Pro Industrial Pro-Cryl Universal Primer B66-310 Series (100 g/L VOC): Applied at a dry film thickness of not less than 3.0 mils.

2.4 INTERIOR FINISH COATS

- A. Interior Semigloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application.
 - 1. Benjamin Moore; Ultra Spec 500 Interior Semi-Gloss Finish No. N539 (0 g/L VOC): Applied at a dry film thickness of not less than 1.8 mils.
 - 2. Pittsburgh Paints; 6-4500 Series Speedhide zero Interior Zero VOC Latex Semi-Gloss (0 g/L VOC): Applied at a dry film thickness of not less than 1.7 mil.
 - 3. Sherwin-Williams; S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series (0 g/L VOC): Applied at a dry film thickness of not less than 1.6 mils.
- B. Interior Semigloss Acrylic Enamel for Metals: Factory-formulated quick-drying rust-inhibitive acrylic.
 - 1. Benjamin Moore; Moore's Super Spec HP DTM Acrylic Semi-Gloss No. HP29 (45 g/L VOC): Applied at a dry film thickness of not less than 3.0 mils.
 - 2. Pittsburgh Paints; Pitt-Tech Plus Low VOC Interior/Exterior Semi-gloss Industrial Enamel 90-1210 (87.9 g/L VOC): Applied at a dry film thickness of not less than 2.5 mils.
 - 3. Sherwin-Williams; S-W Pro Industrial DTM Acrylic Semi-Gloss B66W01 Series (50 g/L VOC): Applied at a dry film thickness of not less than 2.5 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Gypsum Board Substrates: Verify that finishing compound is sanded smooth and is dust free.
- C. Verify suitability of substrates, including surface conditions and compatibility with finishes and primers.
 - 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Provide surface-applied protection before surface preparation and painting.
- C. Repair of Existing Drywall Surfaces: Spackle and sand smooth minor surface imperfections in existing drywall surfaces. Repair is limited to imperfections of not more than 2 square inches in area and 3/8 inch in depth.
- D. Protect all adjacent interior surfaces and areas from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.

- E. Substrate defects shall be made good and sanded by others ready for painting. Start of finish painting of defective surfaces (e.g. gypsum board) shall indicate acceptance of substrate and any costs of making good defects shall be borne by the painter including repainting of entire defective surface (no touchup painting).
- F. Cleaning, General: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings including dust, dirt, oil, grease, and incompatible paints.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- G. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers.
- H. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop primed; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations as follows:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
- I. Shop-Primed Steel Substrates: Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat
- J. Existing Surfaces: Remove all surface contamination such as, oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, and mortar to assure sound bonding to the tightly adhered existing paint.
 - 1. Clean previously painted surfaces to remove dirt, masking tape, labels, adhesives, and other materials that would either be deleterious to adhesion of, or show through, new paint.
 - 2. Scrape all loose, blistered, peeling, scratched or otherwise imperfect paint down to bare substrate and sand adjacent tightly adhering paint to feather edge.
 - 3. Thoroughly wash surfaces and dull by sanding, including concrete masonry surfaces, gypsum board, plaster and metal surfaces.
 - 4. Spot prime all bare areas with appropriate primer before priming entire surface.
- K. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
 - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 - 3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Paint colors, surface treatments, and finishes are indicated in the schedules.
 - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 - 3. Provide finish coats that are compatible with primers used.

4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, 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.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. Mechanical Work: Painting of mechanical work is not required.
- F. Electrical Work: Painting of electrical work is not required.
- G. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat 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.
- H. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.
- J. Painted surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent:

1. Brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
 2. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
 3. Damage due to touching before paint is sufficiently dry or any other contributory cause.
 4. Damage due to application on moist surfaces or caused by inadequate protection from the weather.
 5. Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
- K. Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
1. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 2. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 3. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
 4. When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
- L. Painted surfaces rejected by the Architect shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.4 CLEANING

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
1. Dispose wash water from latex paint to the sanitary sewer. Excess latex paint shall be salvaged for reuse or solidified for disposal with other construction materials. Dry empty latex paint cans and dispose with other construction materials. Contact UM OSEH Hazardous Materials (734-763-4568) to arrange for disposal of solvent based paints and other solvents.
- 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 PROTECTION

- A. Protect adjacent surfaces against damage from paint application. Correct damage to adjacent surfaces by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protection.
1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINT SCHEDULE

- A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
 - 1. Semi-Gloss Acrylic-Enamel Finish: Two finish coats over a primer. Provide semi-gloss finish for all gypsum board walls.
 - a. Primer: Interior gypsum board primer.
 - b. Finish Coats: Interior semi-gloss acrylic enamel.
- B. Ferrous Metal: Provide the following finish systems over ferrous metal, including but not limited to, , hollow metal frames, access panels:
 - 1. Semi-gloss Acrylic-Enamel Finish: Two finish coats over a primer.
 - a. Primer: Interior ferrous-metal primer.
 - b. Finish Coats: Interior semi-gloss acrylic enamel.

3.7 WASTE MANAGEMENT

- A. Close and tightly seal all partly used containers and store protected in well-ventilated, fire-safe area at moderate temperature. Deliver to reuse and/or recycle facilities if not removed from site for Contractor's reuse.
- B. Separate and recycle waste materials, packaging, and all other materials in accordance with the Waste Management Plan and to the maximum extent possible, send to reuse or recycle centers.

END OF SECTION 09 9100

SECTION 10 2113 - TOILET COMPARTMENTS

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 toilet compartments as follows:
 - 1. Solid-color reinforced composite (SCRC) toilet compartments configured as toilet enclosures and urinal screens.
- B. Related Requirements:
 - 1. Section 05 5000 "Metal Fabrications" for supports that attach floor-and-ceiling-anchored compartments and post-to-ceiling screens to overhead structural system.
 - 2. Section 10 2800 "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For toilet compartments.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of centerlines of toilet fixtures.
 - 4. Show locations of floor drains.
 - 5. Show ceiling grid, ceiling-mounted items, and overhead support or bracing locations.
- C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
 - 1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch- square Samples of same thickness and material indicated for Work.
- D. Product Certificates: For each type of toilet compartment.
- E. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 75 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-COLOR REINFORCED COMPOSITE UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Bobrick Washroom Equipment, Inc.; Sierra Series 1096.
- B. Toilet-Enclosure Style: Floor and ceiling anchored.
- C. Urinal-Screen Style: Post to ceiling.
- D. Door, Panel, and Pilaster Construction: Solid, color reinforced composite (SCRC) panel material.
 - 1. Thicknesses:
 - a. Pilasters: 3/4 inch.
 - b. Panels: 1/2 inch.
 - c. Doors: 3/4 inch.
 - d. Backsplash Panels: 1/2 inch.
 - 2. Color: As indicated on Room Finish Schedule on Drawings.
- E. Pilaster Shoes and Sleeves (Caps): Stainless steel, ASTM A 666, Type 304, not less than 22 gage and 4 inches high, with satin finish.
- F. Urinal-Screen Post: Manufacturer's standard post design of 1-1/4-inch-square, stainless steel tube with satin finish; with shoe and sleeve (cap) matching that on the pilaster.
- G. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Extruded aluminum U-channels and angle brackets, with satin finish. Stainless steel brackets are not acceptable.
- H. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
 - 1. Material: 18-8, type-304 stainless steel with satin finish.
 - 2. Door Hardware: Provide for each door the following:
 - a. Hinges: Manufacturer's standard heavy duty, paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
 - 1) Door shall be furnished with two 11-gauge (3mm) stainless steel door stop plates with attached rubber bumpers to resist door from being kicked in/out beyond stile.

- 2) Door stops and hinges shall be secured with machine screws and threaded inserts.
 - a) Fasteners secured directly into the core are not acceptable.
 - b. Latch and Keeper: Sliding door latch shall be 14-gauge with an 11-gauge keeper. Latch shall slide on nylon track. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.
 - 1) Latch track shall be attached to door by machine screws into factory installed threaded brass inserts.
 - 2) Through-bolted fasteners shall be used at latch keeper-to-stile connections.
 - c. Coat Hook: Constructed of stainless steel and shall project no more than 1-1/8" from face of door.
 - 1) Coat hook shall be secured by to door by through-bolted fasteners.
 - d. Door Bumper: Manufacturer's standard vandal resistant rubber-tipped bumper at out-swinging doors.
 - e. Door Pull: Manufacturer's standard vandal resistant unit. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.
3. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel with theft-resistant-type heads and complying with the following:
 - a. Machine Screws and Threaded Inserts:
 - 1) Theft-resistant, stainless steel, pin-in-head Torx machine screws fastened into threaded brass inserts.
 - 2) Threaded brass inserts shall be factory installed and shall withstand a direct pull force exceeding 1,500 lbs per insert.
 - b. Through-bolting:
 - 1) Theft-resistant, stainless steel, pin-in-head Torx sex thru-bolted fasteners shall withstand direct pull force exceeding 1,500 lbs. per fastener.

2.3 MATERIALS

- A. Solid color reinforced composite (SCRC) material with graffiti resistant coating, thermoset and integrally fused into homogenous piece.
 1. Composition: Dyes, organic fibrous material, and polycarbonate/phenolic resins.
 2. Surface Treatment: Non-ghosting, graffiti resistant surface integrally bonded to core through manufacturing steps requiring thermal and mechanical pressure.
 3. Edges: Same color as the surface.
- B. Brass Castings: ASTM B 584.

2.4 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

- B. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
- C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.
- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide in-swinging doors for standard toilet compartments and 36-inch-wide out-swinging doors with a minimum 32-inch-wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position indicated with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch.
 - b. Panels and Walls: 1 inch.
 - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 2113

SECTION 10 2800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following toilet and bath accessory items:
 - 1. Grab bars.
 - 2. Sanitary napkin disposal unit.
 - 3. Stainless steel framed mirror units.
 - 4. Electric hand dryers.
 - 5. Framed Mirror Units
- B. Owner-Furnished/Contractor Installed Material:
 - 1. Toilet Tissue Dispenser
 - 2. Soap dispensers.
- C. Related Sections include the following:
 - 1. Section 10 2113 "Toilet Compartments" for compartments and screens.
 - 2. Division 26 Sections for electrical service to electric hand dryers.

1.3 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. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated on Drawings.
 - 2. Identify products using designations indicated on Drawings.
- C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 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.

1.5 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.

1.6 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Galvanized Steel Sheet: ASTM A 653, with G60 hot-dip zinc coating.
- C. Galvanized Steel Mounting Devices: ASTM A 153, 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. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
 - 1. Safety Glazing Products: For film-backed mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Toilet Tissue Dispenser: Owner furnished/Contractor installed.
- B. Liquid-Soap Dispenser: Owner furnished/Owner installed.
- C. Grab Bars:
 - 1. Mounting: Flanges with concealed fasteners.
 - 2. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4, satin finish.
 - 3. Outside Diameter: 1-1/2 inches.
 - 4. Clearance: 1-1/2-inch clearance between wall surface and inside face of bar.
 - 5. Configuration and Length: As indicated on Drawings.

D. Sanitary-Napkin Disposal Unit:

1. Mounting: Surface mounted.
2. Door or Cover: Self-closing disposal-opening cover and locking bottom panel.
3. Receptacle: Removable.
4. Material and Finish: Stainless steel, No. 4 finish (satin).
5. Products:
 - a. Bradley No. 4781-15.

E. Mirror Unit:

1. Film-Backed Safety Mirrors: Apply film backing with pressure-sensitive adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections. Use adhesives and film backing compatible with mirror backing paint as certified by mirror manufacturer.
2. Frame: Stainless-steel angle, 0.05 inch thick.
 - a. Corners: Welded and ground smooth.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: As indicated on Drawings.

2.3 WARM-AIR DRYERS

A. Electric Hand Dryer: Warm air, rapid drying, energy efficient, UL listed, electric hand dryer with adjustable speed and sound:

1. Mounting: Surface mounted.
2. Operation: Automatic, activated by infrared optical sensor. Operates while hands are under blower. Shut-off within 2 seconds when hands removed, or in 35 seconds if hands not removed.
3. Cover Material and Finish: Vandal resistant one piece stainless steel with brushed finish.
4. Electrical Requirements: Universal voltage of 100-240 V, 60 Hz, 12.5 A maximum at 120V. and 6.5 A maximum at 240 V.
5. Air Outlet: Fixed nozzle delivers focused air stream at average hand position of 4 inches below air outlet.
6. Sound Level: 83 to 69 dB A.
7. Air Velocity: 16,000 to 10,000 LFM.
8. Air Temperature: 135 degF capability.
9. Nominal Size: 10-1/8 inches wide by 9-3/8 inches high by 5-5/8 inches deep.
10. Products:
 - a. American Dryer Inc.; ExtremeAir GXT9-SS.

2.4 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.

- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

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 downward load of at least 250 lbf, when tested according to method in ASTM F 446.

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 10 2800

SECTION 22 0500 – COMMON WORK RESULTS FOR MECHANICAL

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 work of this Section.

1.2 SUMMARY

- A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01 Sections.

1. Substitutions
2. Permits and fees
3. Submittals
4. Coordination drawings
5. Record drawings
6. Maintenance manuals
7. Rough-ins
8. Mechanical installations
9. Cutting and patching

- B. This Section includes basic requirements for materials and installations for mechanical work, including but not limited to:

1. Mechanical demolition work
2. Concrete
3. Sleeves
4. Sealing of openings
5. Access doors
6. Touch-up painting

1.3 REFERENCES

- A. The mechanical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:

1. AABC - Associated Air Balance Council
2. ANSI - American National Standards Institute
3. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
4. ASTM - American Society for Testing Materials
5. NEC - National Electrical Code
6. NFPA - National Fire Protection Association
7. NEMA - National Electrical Manufacturer's Association
8. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
9. UL - Underwriters' Laboratories, Inc.

1.4 SYSTEM DESCRIPTION

- A. Design Requirements: Furnish all labor, materials, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the mechanical systems as specified in the Division 22 and 23 Sections and as indicated on Drawings.
 - 1. The Mechanical Drawings indicate the general design and extent of all equipment, piping and ductwork. Comply with the Drawings as closely as actual construction of the building and the work of other trades permit.
- B. Substitutions: Base Bid must be in accordance with materials or products specified. Any exceptions to this must be approved in writing by the Architect/Engineer ten (10) days or more prior to bidding.
- C. Permits and Fees: Obtain all permits, licenses, inspections and test required. Upon completion of the Work, obtain and send certificates of inspections and approvals to the Architect/Engineer.
 - 1. Pay all fees and expenses for permits, licenses, tests and inspections.
- D. Examination of Drawings and Premises: Before submitting Bids, examine the architectural, electrical and other trades' drawings and specifications.
 - 1. Notify Architect/Engineer should any discrepancies occur between them and the mechanical work.
 - 2. No additional charges will be allowed because of failure to make this examination, or to include all materials and labor required for the Work.
 - 3. Before submitting Bids, examine the premises to determine existing conditions for performing the Work. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.
 - 4. The Architectural Drawings take precedence in all matters pertaining to the building structure, Mechanical drawings in all matters pertaining to Mechanical trades and Electrical drawings in all matters pertaining to Electrical trades installation. However, where there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect/Engineer who shall determine the course of action to be taken.
- E. Changes Involving Electrical Work: The design of the mechanical systems is based on the equipment specified and scheduled on the Drawings.
 - 1. Where equipment changes are made that involve additional electrical work (larger size motors, additional wiring of equipment, etc.) the Mechanical trades involved shall compensate the electrical trades for the cost of the additional Work required.
- F. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.
- G. All equipment of the same or similar systems shall be by the same manufacturer.

1.5 SUBMITTALS

- A. The following is in addition to the requirements for submittals in Division 01.
- B. Material List: Submit a complete list of all materials and equipment, and their manufacturers, for approval by the Architect/Engineer within 15 days after award of contract and prior to submittal of shop drawings.

- C. Shop Drawings: Prepare shop drawings drawn to scale and submit one (1) transparency copy and two (2) prints of each to the Architect/Engineer for review, together with required number of additional copies as required by the General Conditions. After the shop drawings are reviewed, the transparency copy will be stamped and returned for printing and distribution. Refer to Division 1 for submittals and quantities.
1. Submit shop drawings of all sheet metal ductwork with necessary sections, details, dimensions, etc.
 - a. All sheet metal shop drawings shall bear balance agency approval stamp prior to submittal to Architect/Engineer.
 - b. Submit shop drawings and product data for all equipment, materials, valves, plumbing and heating specialties, refrigeration specialties, pipe hangers, wiring diagrams and control diagrams including but not limited to items indicated below.
- D. No apparatus or equipment shall be shipped from stock or fabricated until shop drawings for them have been reviewed by the Architect/Engineer. By the review of shop drawings, the Architect/Engineer does not assume responsibility for actual dimensions or for the fit of completed work in position, nor does such review relieve Mechanical Trades of full responsibility for the proper and correct execution of the work required.
- E. Submit shop drawing with all pertinent data and with identification mark number or symbol numbers as specified or scheduled on the Mechanical Drawings.
- F. Shop drawings shall be reviewed by the Mechanical Contractor for completeness and accuracy prior to submitting to the Architect/Engineer for review. The shop drawings shall be dated and signed by the Mechanical Contractor prior to submission.
- G. Where the shop drawings consist of manufacturer's standard detail drawing or schedules and contain data for a variety of similar equipment, indicate the data pertinent to the equipment furnished for this project only. Standard detail drawings and schedules not clearly indicating which data is associated with this Project shall be returned "Rejected".
- H. Where accessories and/or options are specified and do not appear as part of manufacturer's standard detail drawings, state each accessory that is to be provided with the equipment on the standard detail drawings.
- I. Partial submittals for equipment will not be permitted. Where partial submittals are transmitted to the Architect/Engineer, they will be returned "Rejected".
- J. Plumbing fixture submittals shall be submitted as one (1) package including all fixtures intended to be used for this Project.
- K. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Provide a space approximately 4" x 5" on the label or beside the title block on shop drawings to record the Contractor's review and approval markings and the action taken.
 2. Include the following information on the label for processing and recording action taken.
 - a. Project Name
 - b. Date
 - c. Name and address of Architect/Engineer
 - d. Name and address of Contractor
 - e. Name and address of Subcontractor
 - f. Name and address of Supplier
 - g. Name of Manufacturer

- h. Number and title of appropriate Specification Section
 - i. Drawing number, identification mark, fixture type, and detail references, or as noted on the mechanical drawings.
- L. Submit manufacturer's submittals on all major mechanical systems and/or equipment, including:
 - 1. Cabinet Unit Heaters
 - 2. Valves
 - 3. Plumbing Specialties
 - 4. Exhaust Fans
 - 5. Grilles, Registers and Diffusers
 - 6. Temperature Controls
 - 7. Insulation
 - 8. Vibration Isolators
- M. Project Record Documents: Revise shop drawings as required during construction to indicate the as-built condition.
 - 1. At the completion of the Project, resubmit to the Owner's Representative the revised sepias and one set of prints for Owner's record.
 - 2. Furnish and deliver to the Owner's Representative a manual of all shop drawings and product data upon substantial completion. The manual shall consist of a standard hard cardboard, vinyl covered, 3-ring binder, letterhead size, 8-1/2" x 11". Shop drawings shall be folded and punched. All items and pages shall be numbered with typewritten index inserted at front of manual.
 - 3. Submit final project record documents as described in Division 01.
- N. Operation and Maintenance Data: Retain operating instructions, service instructions, parts lists, etc., which are shipped with mechanical equipment. On completion of the work, give these items to the Architect/Engineer, for the Owner's use. If this information is not shipped with the equipment, obtain from the manufacturer.
 - 1. Furnish two (2) sets of bound operating instructions to the Architect/Engineer. Each set shall include:
 - a. One (1) copy of all shop drawings
 - b. Operating and maintenance instructions
 - c. As-built drawings

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Ordinances and Codes: Perform all work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of ASHRAE, NFPA, SMACNA and UL, unless otherwise indicated.
 - a. Notify the Architect/Engineer before submitting his proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations. After entering into Contract, make all changes required to conform to above ordinances, rules and regulations without additional expense to the Owner.
 - b. Barrier-Free Regulations: Comply with the requirements of the State of Michigan Handicapped Barrier-Free Regulations and with the Americans with Disabilities Act (ADA).

1.7 DELIVERY, STORAGE AND HANDLING

- A. Storage and Protection: Provide adequate storage space for all mechanical equipment and materials delivered to the job site under a weather protected enclosure. Location of the space will be designated by the Owner's Representative. Equipment set in place in unprotected areas must be provided with temporary protection.
1. Be responsible for the care and protection of mechanical equipment until it has been fully tested and accepted.
 - a. Protect equipment and materials from damage or theft.
 2. Protect materials with permanent factory finish from damage by covering.
 3. Protect materials with enamel or glaze surfaces by covering or coating as recommended in "Handling and Care of Enameled Cast Iron Plumbing Fixtures" bulletin, issued by the Plumbing Fixtures Manufacturers Association and as approved.
 4. Coat polished or plated metal parts with white petroleum jelly immediately after installation.
 5. Protect equipment outlets, pipe and duct openings with temporary plugs or caps.
 6. Care and protection of electrical equipment furnished by Mechanical Trades and installed by Electrical Trades shall be the responsibility of the Electrical Trades after receiving equipment from Mechanical.

1.8 PROJECT/SITE CONDITIONS

- A. Field Measurements:
1. Drawings are not intended to be scaled for roughing-in or to serve as shop drawings. Take all field measurements required for fitting the installation to the building.

1.9 SEQUENCING AND SCHEDULING

- A. Sequence and schedule work so as to avoid interference with the work of other Trades. Be responsible for removing and relocating any work which in the opinion of the Owner's Representatives causes interference.

1.10 WARRANTY

- A. Warranty: Warranty the mechanical installation to be free from defects and replace or repair, to the satisfaction of the Owner, any part of the mechanical installation which may fail within a period of one year after substantial completion, provided that such failure is due to defects in materials or workmanship or to failure to follow the Contract Documents.
1. File with the Owner any and all warranties from equipment manufacturers and what operating conditions and performance capacities they are based on. Refer to Division 01 Sections.

1.11 MAINTENANCE

- A. Maintenance Materials: Retain all portable and detachable portions of the installation such as keys, tools, manuals, etc., until the completion of the work and then turn them over to the Owner and obtain itemized receipt. This receipt shall be attached to the "Final Application" for payment.
- B. Retain operating instructions, service instructions, parts lists, etc., which are shipped with electrical equipment. On completion of the Work, give these items to the Architect/Engineer for the Owner's use. If this information is not shipped with the equipment, obtain from the manufacturer.

- C. Furnish three (3) sets of bound operating instructions to the Architect/Engineer. Each set shall include:
1. One (1) copy of all shop drawings
 2. Operating and maintenance instructions and manuals
 3. As-built drawings

PART 2 - PRODUCTS

2.1 MECHANICAL EQUIPMENT – GENERAL

- A. All major items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment and shall be the manufacturer's latest design.

2.2 CONCRETE

- A. Provide concrete work required for the mechanical installation. Concrete work shall include housekeeping pads beneath equipment and vibration isolation bases. Concrete work shall be in conformance with the Section 03 3000 or as indicated.

2.3 ACCESS DOORS

- A. Furnish access doors as required to make accessible all valves, controls, coils, motors, air vents, filters, electrical boxes and other equipment installed by Mechanical trades or as required by Code.
1. Architectural trades will install access doors provided under this Section.
 2. Access door size shall be minimum 12" x 12" in walls, 24" x 24" in ceilings.
 3. Plaster or acoustical tile inserts shall be by Architectural trades.
 4. Equip access doors with screwdriver operated cam lock.
 - a. At recessed panel access doors to receive plaster or acoustical tile inserts, furnish plastic grommet and sleeve at lock.
 5. Access doors in fire rated walls or ceilings shall be 1-1/2 hour rated, "B" label, 250 degF maximum temperature rise in 30 minutes, shall be self-closing and self-latching and shall carry Underwriters' Laboratories, Inc. (UL) or Warnock-Hersey Label.
- B. In non-fire rated drywall, veneer plaster, masonry or ceramic tile walls, furnish "Type M, 3202 Series" access doors as manufactured by Milcor Ltd. Partnership or approved equal.
- C. In non-fire rated gypsum board or veneer plaster walls and ceilings, furnish "Type DW, 3203 Series" by Milcor Ltd. Partnership or approved equal.
- D. In fire-rated drywall, veneer plaster, masonry or ceramic tile walls, furnish "3208 Series" by Milcor Ltd. Partnership or approved equal.
- E. In non-fire rated drywall, veneer plaster or plaster ceilings, furnish "Type M, 3202 Series" by Milcor Ltd. Partnership or approved equal.
- F. In non-fire rated plaster walls or ceilings, furnish "Type K, 3200 Series" by Milcor Ltd. Partnership or approved equal.
- G. In non-fire rated plaster or acoustical tile ceilings, furnish "Type AP, 3206 Series" and "Type AT, 3205 Series" by Milcor Ltd. Partnership or approved equal.

2.4 SEALING OF OPENINGS (FIRE STOPPING)

- A. Seal openings around pipes in sleeves and around duct openings through walls, floors and ceilings, and where floors, fire rated walls and smoke barriers are penetrated. (Fiberglass is not acceptable.) Fire and/or smoke barriers shall be UL Listed fire and smoke stop fittings and shall have fire rating equal to or greater than the penetrated barrier. Refer to Section 07 8413 "Firestopping" for additional requirements.
 - 1. Products:
 - a. 3M
 - b. Hilti
 - c. Tremco
 - d. Manville

2.5 SLEEVES

- A. Provide sleeves where pipes pass through floors, walls, and ceilings.
- B. Sleeves shall be steel pipe. Where specific sizes are not indicated on the Drawings, sleeves shall be sized to provide one-half (1/2) inch clearance around the outside surface of the item for which they were installed. They shall be cut flush with wall and ceiling surfaces in finished areas, and shall extend one-half inch above floor. Sleeves shall be packed with approved non-combustible packing material and sealed with sealant to prevent passage of air, liquid or fumes from one area to another. The filler and sealant materials used shall be rated at least equal in fire resistance to the construction material being penetrated. Floor sleeves shall be sealed between floor and sleeve with concrete grout. Refer to Section 07 8413 "Firestopping".

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION WORK

- A. General: Perform mechanical demolition work in a systematic manner. Use such methods as outlined below to complete Work indicated on Drawings.
- B. Obtain approval from the Owner prior to interrupting existing services. All service interruptions shall be at a time suitable to the Owner. Where the Owner approves service interruptions at times resulting in premium time work to this Contractor, this Contractor shall include the premium time in his Base Bid.
- C. Remove existing mechanical equipment, components and materials, including but not limited to piping, heating units, plumbing fixtures, pumps, supports and other mechanical items made obsolete by the new work.
 - 1. Where existing equipment is removed, piping shall be capped under floor or behind face of wall.
- D. Work that has been cut or partially removed shall be protected against damage.
- E. Materials salvaged from this work shall not be reused except where reuse is specifically indicated.
- F. Existing fixtures and mechanical equipment removed, not reused and not specifically indicated to be turned over to the Owner shall be legally and properly disposed of off Owner's property.
- G. Existing fixtures and mechanical equipment specifically indicated to be turned over to the Owner shall be carefully disconnected, removed and turned over to the Owner in a storage area as directed by the Owner.

3.2 TEMPORARY SERVICES

- A. Provide temporary water and heat service as described in Division 01.
- B. The existing building will be occupied during construction. Maintain mechanical services and provide necessary temporary connections and their removal at no additional expense.
- C. New equipment installed shall not be used for temporary construction use without prior written approval from Owner's representative.

3.3 CUTTING AND PATCHING

- A. Refer to Division 01 for requirements for cutting, patching and refinishing work necessary for the installation of Mechanical Work.
- B. Direct miscellaneous cutting and patching of the existing building construction for the installation of the Mechanical Work.
- C. The cutting of holes through the existing building construction shall only be done by the use of abrasive saws and rotary coring machines. The use of hammer and drill points will not be permitted. The openings shall not be cut larger than necessary for the installation of the mechanical work. Openings shall then be grouted in. Where existing piping, etc. is removed, the unused openings shall be grouted in.
- D. The drilling or punching of structural members, such as holes through beams or columns, shall not be done without the specific permission of the Architect/Engineer.
- E. Cutting of holes through floors and walls shall be done only at such locations as may be directed by the Architect/Engineer.
- F. Cooperate with the other Contractors so that all cutting and repairing in any given area will be done simultaneously.
- G. Mechanical work which may interfere with changes in conduit or other electrical equipment, that may be uncovered by the cutting of new openings in present building, shall be removed at the direction of the Architect/Engineer.

3.4 DAMAGE TO OTHER WORK

- A. The Mechanical Trades will be responsible for all damage to other Work caused by their Work or through the neglect of their workers.
 - 1. All patching and repairing of any such damaged Work shall be performed by the trades which installed the Work, but the cost shall be paid by the Mechanical Trades.

3.5 CHASES AND RECESSES

- A. Provide sizes and locations of chases and recesses affecting the mechanical work for provision by general trades.

3.6 EXCAVATION AND BACKFILL

- A. Furnish excavating and backfilling to install work specified in the Mechanical Division.
- B. Provide all pumping and well pointing required to keep mechanical excavations dry.

3.7 EQUIPMENT FOUNDATIONS AND SUPPORTS

- A. Furnish foundations and supports for mechanical equipment and materials as required by codes, as listed hereinafter and shown or noted on the Drawings.
- B. Provide necessary inserts, rod, structural steel frames, brackets, platforms, etc., for equipment suspended from ceilings or walls.
- C. Inserts for equipment support shall be lead shield anchors for small work and expansion shields for large work. Wooden plugs will not be allowed. Do not use metal roof decking and cellular floors for supporting equipment.
- D. Provide and install concrete bases 4" above finished floor, with leveling channels, where noted, for floor-mounted equipment.
- E. Concrete bases shall be provided by Architectural Trades, the correct size and location shall be by Mechanical Trades. Mechanical Trades shall furnish and locate anchor bolts and sleeves, for installation by Architectural Trades.

3.8 STRUCTURAL AND ELECTRICAL INTERFERENCES

- A. Should construction conditions prevent the installation of mechanical equipment at locations shown on the drawings, minor deviations may be permitted and shall be as directed by the Architect/Engineer, and shall be made without additional cost to Owner.

3.9 COORDINATION WITH OTHER TRADES

- A. Install Work so as to avoid interferences with the Work of other trades. Be responsible for removing and relocating any work which, in the opinion of the Owner's Representative, causes interferences.

3.10 ASSEMBLY OF EQUIPMENT

- A. The Contract Drawings and Specifications indicate items to be purchased and installed which are noted by a manufacturer's name, catalog number and/or brief description.
- B. The catalog number may not designate all the accessory parts and appurtenances required for the particular use or function.
- C. Arrange with the manufacturer for the purchase of all items required for the complete installation and efficient operation.

3.11 LUBRICATION

- A. Provide all oil for the operation of the equipment until substantial completion. Contractor shall be held responsible for all damage to bearings while the equipment is being operated by him up to the date of acceptance of the equipment. Protect all bearings and shafts during installation and thoroughly grease the steel shafts to prevent corrosion. All motors and other equipment shall be provided with covers as required for proper protection during construction.

3.12 EQUIPMENT CONNECTIONS

- A. Connections to equipment, fixtures, etc., shall be made in accordance with the shop drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. Any and all additional connections not shown on the Drawings but called for by the equipment manufacturer's shop drawings or required for the successful operation of the particular equipment furnished shall be installed as part of this Contract at no additional charge to the Owner.

- B. All fittings connecting to equipment on piping 2-1/2 inches and above in size, shall be flanged, standard weight pattern with flat machine face provided with ring gaskets.
- C. All fittings connecting to equipment on piping 2 inches and below in size shall be made with unions.
- D. All piping connections to pumps and other equipment shall be installed without strain at the pipe connection of the equipment.
 - 1. When directed, remove the bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected.
- E. Brass couplings shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

3.13 TESTING DUCTS AND PIPES FOR OBSTRUCTIONS

- A. Ducts and pipes which are installed underground or concealed in concrete floor slab, foundations, etc., shall be cleared of foreign material and obstructions after installation.

3.14 PAINTING

- A. In general, no painting is required by Mechanical Trades other than touch-up of factory-finished mechanical equipment.
- B. All factory finished mechanical equipment shall be cleaned at completion of the job. Equipment showing rust or mars shall be thoroughly cleaned and sanded, prime coated and touched up with enamel of color to match original finish.

3.15 FIELD QUALITY CONTROL

- A. Tests and Inspection: When the systems are completed, operate equipment as directed by Architect/Engineer. Replace all faulty equipment. Make necessary adjustments before final acceptance.
 - 1. Perform all tests required by State, City, County and/or other agencies having jurisdiction.
 - 2. Provide all materials, equipment, etc., and labor required for tests.

3.16 CLEANING

- A. Keep premises free from accumulation of waste materials and rubbish. At completion of work remove all rubbish from and about the building and leave the mechanical systems clean and ready for use.

END OF SECTION 22 0500

SECTION 22 0510 – BASIC MECHANICAL MATERIALS AND METHODS

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 basic mechanical materials and methods to complement other Division 21, 22 and 23 Sections.
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Escutcheons.
 - 3. Dielectric fittings.
 - 4. Flexible connectors.
 - 5. Mechanical sleeve seals.
 - 6. Equipment nameplate data requirements.
 - 7. Labeling and identifying mechanical systems and equipment is specified in Division 22 Section "Mechanical Identification."
 - 8. Nonshrink grout for equipment installations.
 - 9. Field-fabricated metal and wood equipment supports.
 - 10. Installation requirements common to equipment specification sections.
 - 11. Mechanical demolition.
 - 12. Cutting and patching.
 - 13. Touchup painting and finishing.
- B. Pipe and pipe fitting materials are specified in Division 22 piping system Sections.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, 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 duct shafts.
- 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. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. NP: Nylon plastic.
 - 4. PE: Polyethylene plastic.
 - 5. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

- A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.
- B. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.
- C. Coordination Drawings: For access panel and door locations.
- D. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
1. Planned piping layout, including valve and specialty locations and valve-stem movement.
 2. Clearances for installing and maintaining insulation.
 3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 4. Equipment and accessory service connections and support details.
 5. Exterior wall and foundation penetrations.
 6. Fire-rated wall and floor penetrations.
 7. Sizes and location of required concrete pads and bases.
 8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
 9. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
 10. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.
- E. Samples: Of color, lettering style, and other graphic representation required for each identification material and device.

1.5 QUALITY ASSURANCE

- A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning 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 prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

- C. Protect flanges, fittings, and piping specialties from moisture and dirt.
- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."
- G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Dielectric Unions:
 - a. Epco Sales Inc.
 - b. Hart Industries International, Inc.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. Zurn Industries, Inc.; Wilkins Div.
 - 2. Dielectric Flanges:
 - a. Epco Sales Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - 3. Dielectric-Flange Insulating Kits:
 - a. Calpico, Inc.
 - b. Central Plastics Co.
 - 4. Dielectric Couplings:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.

- 5. Dielectric Nipples:
 - a. Grinnell Corp.; Grinnell Supply Sales Co.
 - b. Perfection Corp.
 - c. Victaulic Co. of America.
- 6. Mechanical Sleeve Seals:
 - a. Calpico, Inc.
 - b. Metraflex Co.
 - c. Thunderline/Link-Seal.

2.2 PIPE AND PIPE FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe 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: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32.
 - 1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
 - 2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
 - 3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
 - 4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
 - 5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.
- F. Brazing Filler Metals: AWS A5.8.
 - 1. BCuP Series: Copper-phosphorus alloys.
 - 2. BAg1: Silver alloy.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

- H. Solvent Cements: Manufacturer's standard solvent cements for the following:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.
- I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.
- K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
 - 1. Sleeve: ASTM A 126, Class B, gray iron.
 - 2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
 - 3. Gaskets: Rubber.
 - 4. Bolts and Nuts: AWWA C111.
 - 5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.
- G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- H. 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.

2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.6 PIPING SPECIALTIES

- A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
 2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
 5. PVC: Manufactured, permanent, with nailing flange for attaching to wooden forms.
 6. PVC Pipe: ASTM D 1785, Schedule 40.
 7. PE: Manufactured, reusable, tapered, cup shaped, smooth outer surface, with nailing flange for attaching to wooden forms.
- B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
 2. OD: Completely cover opening.
 3. Cast Brass: One piece, with set screw.
 - a. Finish: Rough brass.
 - b. Finish: Polished chrome-plate.
 4. Cast Brass: Split casting, with concealed hinge and set screw.
 - a. Finish: Rough brass.
 - b. Finish: Polished chrome-plate.
 5. Stamped Steel: One piece, with set screw and chrome-plated finish.
 6. Stamped Steel: One piece, with spring clips and chrome-plated finish.
 7. Stamped Steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.
 8. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
 9. Stamped Steel: Split plate, with exposed-rivet hinge, set screw, and chrome-plated finish.
 10. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome-plated finish.
 11. Cast-Iron Floor Plate: One-piece casting.

2.7 IDENTIFYING DEVICES AND LABELS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 21, 22 and 23 Sections. If more than one type is specified for application, selection is Installer's option, but provide one selection for each product category.
- B. Label all control devices and panels.
- C. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.
1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
 2. Location: Accessible and visible location.

- D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap on, color-coded, complying with ASME A13.1.
- E. Plastic Duct Markers: Manufacturer's standard color-coded, laminated plastic. Comply with the following color code:
1. Yellow/Green or Green: Supply air.
 2. Blue: Exhaust, outside, return, and mixed air.
 3. Nomenclature: Include the following:
 - a. Direction of airflow.
 - b. Duct service.
 - c. Duct origin.
 - d. Duct destination.
 - e. Design cubic feet per meter.
- F. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated.
1. Fabricate in sizes required for message.
 2. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
 3. Punch for mechanical fastening.
 4. Thickness: 1/16-inch, unless otherwise indicated.
 5. Thickness: 1/8-inch, unless otherwise indicated.
 6. Thickness: 1/16-inch, for units up to 20 sq. in. or 8-inches long; 1/8-inch for larger units.
 7. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.
- G. Plastic Equipment Markers: Color-coded, laminated plastic. Comply with the following color code:
1. Green: Cooling equipment and components.
 2. Yellow: Heating equipment and components.
 3. Yellow/Green: Combination cooling and heating equipment and components.
 4. Brown: Energy reclamation equipment and components.
 5. Blue: Equipment and components that do not meet any criteria above.
 6. For hazardous equipment, use colors and designs recommended by ASME A13.1.
 7. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, and rpm.
 8. Size: Approximate 2-1/2 by 4-inches for control devices, dampers, and valves; and 4-1/2 by 6-inches for equipment.
- H. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.
1. Multiple Systems: If multiple systems of same generic name are indicated, provide identification that indicates individual system number and service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

2.8 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psig, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 22 piping Sections specify unique piping installation requirements.
- B. General Locations and Arrangements: 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 at indicated slope.
- D. Install components with pressure rating equal to or greater than system operating pressure.
- E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- F. Install piping free of sags and bends.
- G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- I. Install piping to allow application of insulation plus 1-inch clearance around insulation.
- J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- K. Install fittings for changes in direction and branch connections.
- L. Install couplings according to manufacturer's written instructions.
- M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
 - 1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
 - 2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
 - 3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
 - 4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
 - 5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.
- N. Sleeves are not required for core drilled holes.

- O. Permanent sleeves are not required for holes formed by PE removable sleeves.
- P. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
- Q. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2-inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Build sleeves into new walls and slabs as work progresses.
 - 3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. PVC Pipe Sleeves: For pipes smaller than 6-inch NPS.
 - b. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
 - c. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
 - d. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2-inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 07 Section "Joint Sealants" for materials.
 - 5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.
- R. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6-inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6-inches in diameter and larger.
 - 3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- S. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- T. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 07 Section "Firestopping" for materials.
- U. Verify final equipment locations for roughing-in.
- V. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

W. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube."
5. Soldered Joints: Construct joints according to CDA's "Copper Tube Handbook."
6. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
7. 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:
 - a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. 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.
8. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
9. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
10. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. ABS Piping: ASTM D 2235 and ASTM D 2661.
 - c. CPVC Piping: ASTM D 2846 and ASTM F 493.
 - d. PVC Pressure Piping: ASTM D 2672.
 - e. PVC Nonpressure Piping: ASTM D 2855.
 - f. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.

X. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install mechanical 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.
- E. Install equipment giving right of way to piping installed at required slope.
- F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 LABELING AND IDENTIFYING

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 - 1. Stenciled Markers: According to ASME A13.1.
 - 2. Plastic markers, with application systems. Install on insulation segment if required for hot, uninsulated piping.
 - 3. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior nonconcealed locations:
 - a. Near each valve and control device.
 - b. Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
 - c. Near locations if pipes pass through walls, floors, ceilings, or enter nonaccessible enclosures.
 - d. At access doors, manholes, and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced at maximum of 50-foot intervals along each run. Reduce intervals to 25-feet in congested areas of piping and equipment.
 - g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of mechanical equipment.
 - 1. Lettering Size: Minimum 1-inch high lettering for name of unit if viewing distance is less than 24-inches, 1/2-inch high lettering for distances up to 72-inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
 - 2. Text of Signs: Provide name of identified unit. Include text to distinguish between multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows, showing duct system service and direction of flow.
 - 1. Location: In each space, if ducts are exposed or concealed by removable ceiling system, locate signs near points where ducts enter into space and at maximum intervals of 50-feet.

- D. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.

3.4 PAINTING AND FINISHING

- A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.
- B. Apply paint to exposed piping according to the following, unless otherwise indicated:
 - 1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 - 2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
 - 3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 - 4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
 - 5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
 - 6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
- C. Do not paint piping specialties with factory-applied finish.
- D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.7 DEMOLITION

- A. Disconnect, demolish, and remove Work specified in Division 21, 22 and 23 Sections.
- B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
- D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2-inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

- E. Removal: Remove indicated equipment from Project site.
- F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.8 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

3.9 GROUTING

- A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placing of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases to provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION 22 0510

SECTION 22 0519 - METERS AND GAGES FOR 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 meters and gages for mechanical systems and water meters installed outside the building.

1.3 SUBMITTALS

- A. Product Data: Include scale range, ratings, and calibrated performance curves for each meter, gage, fitting, specialty, and accessory specified.
- B. Shop Drawings: Include schedule indicating manufacturer's number, scale range, fittings, and location for each meter and gage.
- C. Product Certificates: Signed by manufacturers of meters and gages certifying accuracies under specified operating conditions and compliance with specified requirements.
- D. Shop Drawings: For brackets for duct-mounting thermometers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Liquid-in-Glass Thermometers:
 - a. Dresser Industries, Inc.; Instrument Division; Weksler Instruments Operating Unit
 - b. Ernst Gage Company
 - c. Marsh Bellofram
 - d. Terice: H. O. Terice Company
 - e. Weiss Instruments, Inc.
 - f. Miljoco, Inc.
 - 2. Pressure Gages:
 - a. Dresser Industries, Inc.; Instrument Division; Ashcroft Commercial Sales Operation
 - b. Dresser Industries, Inc.; Instrument Division; Weksler Instruments Operating Unit
 - c. Terice: H. O. Terice Company
 - d. Weiss Instruments, Inc.
 - e. Miljoco, Inc.
 - 3. Test Plugs:
 - a. Terice: H. O. Terice Company
 - b. Watts Industries, Inc.; Water Products Division

2.2 THERMOMETERS – GENERAL

- A. Scale Range: Temperature ranges for services listed are as follows:
 - 1. Domestic Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
 - 2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.
 - 3. Hot Water: 30 to 300 deg F, with 2-degree scale divisions.
- B. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

2.3 LIQUID-IN-GLASS THERMOMETERS

- A. Description: ASTM E 1.
- B. Case: Die cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 9-inches long.
- C. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
- D. Tube: Red or blue reading, organic-liquid filled with magnifying lens.
- E. Scale: Satin-faced non-reflective aluminum with permanently etched markings.
- F. Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

2.4 SEPARABLE SOCKETS

- A. Description: Fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem.
 - 1. Material: Brass, for use in copper piping.
 - 2. Material: Steel, for use in steel piping.
 - 3. Extension-Neck Length: Nominal thickness of 2-inches, but not less than thickness of insulation. Omit extension neck for sockets for piping not insulated.
 - 4. Insertion Length: To extend 2-inches into pipe.
 - 5. Cap: Threaded, with chain permanently fastened to socket.
 - 6. Heat-Transfer Fluid: Oil or graphite.

2.5 THERMOMETER WELLS

- A. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.
 - 1. Material: Brass, for use in copper piping.
 - 2. Material: Steel, for use in steel piping.
 - 3. Extension-Neck Length: Nominal thickness of 2-inches, but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
 - 4. Insertion Length: To extend 2-inches into pipe.
 - 5. Cap: Threaded, with chain permanently fastened to socket.
 - 6. Heat-Transfer Fluid: Oil or graphite.

2.6 PRESSURE GAGES

- A. Description: ASME B40.1, phosphor-bronze bourdon-tube type with bottom connection; dry type, unless liquid-filled-case type is indicated.

- B. Case: Drawn steel, brass, or aluminum with 4-1/2-inch diameter, glass lens.
- C. Connector: Brass, NPS 1/4.
- D. Scale: White-coated aluminum with permanently etched markings.
- E. Accuracy: Grade A, plus or minus 1 percent of middle 50 percent of scale.
- F. Range: Comply with the following:
 - 1. Vacuum: 30-inches Hg of vacuum to 15 psig of pressure.
 - 2. Fluids under Pressure: Two times the operating pressure.

2.7 PRESSURE-GAGE FITTINGS

- A. Valves: NPS 1/4 brass or stainless-steel needle type.
- B. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
- C. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

2.8 TEST PLUGS

- A. Description: Nickel-plated, brass-body test plug in NPS 1/2 fitting.
- B. Body: Length as required to extend beyond insulation.
- C. Pressure Rating: 500 psig minimum.
- D. Core Inserts: Two self-sealing valves, suitable for inserting 1/8-inch OD probe from dial-type thermometer or pressure gage.
- E. Core Material for Air and Water: Minus 30 to plus 275 deg F, ethylene-propylene-diene terpolymer rubber.
- F. Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.
- G. Test Kit: Pressure gage and adapter with probe, two bimetal dial thermometers, and carrying case.
 - 1. Pressure Gage and Thermometer Ranges: Approximately two times the system's operating conditions.

PART 3 - EXECUTION

3.1 METER AND GAGE INSTALLATION – GENERAL

- A. Install meters, gages, and accessories according to manufacturer's written instructions for applications where used.

3.2 THERMOMETER INSTALLATION

- A. Install thermometers and adjust vertical and tilted positions.
- B. Install in the following locations:
 - 1. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
- C. Install separable sockets in vertical position in piping tees where fixed thermometers are indicated.
 - 1. Install with socket extending a minimum of 2-inches into fluid.
 - 2. Fill sockets with oil or graphite and secure caps.
- D. Install thermometer wells in vertical position in piping tees where test thermometers are indicated.
 - 1. Install with stem extending a minimum of 2-inches into fluid.
 - 2. Fill wells with oil or graphite and secure caps.

3.3 PRESSURE-GAGE INSTALLATION

- A. Install pressure gages in piping tees with pressure-gage valve located on pipe at most readable position.
- B. Install pressure-gage needle valve and snubber in piping to pressure gages.

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:
 - 1. Install meters and gages adjacent to machines and equipment to allow service and maintenance.
- B. Ground electrically operated meters.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 ADJUSTING AND CLEANING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.
- C. Clean windows of meters and gages and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

END OF SECTION 22 0519

SECTION 22 0523 - VALVES

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 general-duty valves:
 - 1. Copper-alloy ball valves
 - 2. Ferrous-alloy butterfly valves
 - 3. Bronze check valves
 - 4. Gray-iron swing check valves
 - 5. Ferrous-alloy wafer check valves
 - 6. Bronze gate valves
 - 7. Cast-iron gate valves
 - 8. Bronze globe valves
 - 9. Cast-iron plug valves
 - 10. Resilient-seated, cast-iron, eccentric plug valves

1.3 DEFINITIONS

- A. The following are standard abbreviations for valves:
 - 1. CWP: Cold working pressure.
 - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 3. NBR: Acrylonitrile-butadiene rubber.
 - 4. PTFE: Polytetrafluoroethylene plastic.
 - 5. SWP: Steam working pressure.
 - 6. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.
 - 1. Exceptions: Domestic hot- and cold-water, piping valves unless referenced.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- 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 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES – GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: **NPS 2** and smaller with threaded ends, unless otherwise indicated.
- C. Ferrous Valves: **NPS 2-1/2** and larger with flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- F. Valve Actuators:
 - 1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
 - 2. Gear Drive: For quarter-turn valves, provide gear operators for all butterfly valve sizes.
 - 3. Handwheel: For valves other than quarter-turn types.
 - 4. Lever Handle: For quarter-turn valves **NPS 6** and smaller, except plug valves.
 - 5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

- G. Extended Valve Stems: On insulated valves.
- H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- I. Valve Bypass and Drain Connections: MSS SP-45.

2.3 COPPER-ALLOY BALL VALVES

- A. Manufacturers:
 - 1. Two-Piece, Copper-Alloy Ball Valves:
 - a. Conbraco Industries, Inc.; Apollo Division
 - b. Crane Company; Crane Valve Group; Crane Valves
 - c. Crane Company; Crane Valve Group; Stockham Division
 - d. Grinnell Corporation
 - e. Milwaukee Valve Company
 - f. NIBCO INC.
- B. Copper-Alloy Ball Valves, General: MSS SP-110.
- C. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and **600 psig** minimum CWP rating and blowout-proof stem.

2.4 FERROUS-ALLOY BUTTERFLY VALVES

- A. Manufacturers:
 - 1. Flanged, Ferrous-Alloy Butterfly Valves, Wafer-Lug Type:
 - a. Grinnell Corporation
 - b. Crane Company
 - c. Demco
 - d. Keystone
 - e. Milwaukee Valve Company
 - f. Gray
 - g. Dezudk
 - h. NIBCO, Inc.
 - 2. Grooved-End, Ductile-Iron Butterfly Valves:
 - a. Grinnell Corporation
 - b. Victaulic Company of America
- B. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.
- C. Flanged, Full Lug, **150 psig** CWP Rating, Ferrous-Alloy Butterfly Valves: Flanged-end type with one- or two-piece stem.

2.5 BRONZE CHECK VALVES

A. Manufacturers:

1. Type 1, Bronze, Horizontal Lift Check Valves with Metal Disc:
 - a. Crane Company; Crane Valve Group; Crane Valves
 - b. Crane Company; Crane Valve Group; Stockham Division
 - c. Hager
 - d. NIBCO, Inc.
 - e. Grinnell Corporation
2. Type 1, Bronze, Vertical Lift Check Valves with Metal Disc:
 - a. Crane Company; Crane Valve Group; Crane Valves
 - b. Crane Company; Crane Valve Group; Jenkins Valves
3. Type 3, Bronze, Swing Check Valves with Metal Disc:
 - a. Crane Company; Crane Valve Group; Crane Valves
 - b. Crane Company; Crane Valve Group; Jenkins Valves
 - c. Crane Company; Crane Valve Group; Stockham Division
 - d. Grinnell Corporation
 - e. Milwaukee Valve Company
 - f. NIBCO INC.

B. Bronze Check Valves, General: MSS SP-80.

C. Type 1, Class 125, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.

D. Type 1, Class 125, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.

E. Type 3, Class 125, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

2.6 GRAY-IRON SWING CHECK VALVES

A. Manufacturers:

1. Type I, Gray-Iron Swing Check Valves with Metal Seats:
 - a. Crane Company; Crane Valve Group; Crane Valves
 - b. Crane Company; Crane Valve Group; Jenkins Valves
 - c. Crane Company; Crane Valve Group; Stockham Division
 - d. Grinnell Corporation
 - e. Milwaukee Valve Company
 - f. Mueller Company
 - g. NIBCO INC.
2. Type II, Gray-Iron Swing Check Valves with Composition to Metal Seats:
 - a. Crane Company; Crane Valve Group; Crane Valves
 - b. Crane Company; Crane Valve Group; Stockham Division

3. Grooved-End, Ductile-Iron Swing Check Valves:

- a. Grinnell Corporation
- b. Victaulic Company of America

B. Gray-Iron Swing Check Valves, General: MSS SP-71.

C. Type I, Class 125, gray-iron, swing check valves with metal seats.

D. Type II, Class 125, gray-iron, swing check valves with composition to metal seats.

E. **175-psig** CWP Rating, Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends.

2.7 FERROUS-ALLOY WAFER CHECK VALVES

A. Manufacturers:

1. Dual-Plate, Ferrous-Alloy, Wafer Check Valves:

- a. Crane Company; Crane Valve Group; Crane Valves
- b. Crane Company; Crane Valve Group; Stockham Division
- c. Grinnell Corporation
- d. NIBCO INC.

2. Dual-Plate, Ferrous-Alloy, Wafer-Lug Check Valves:

- a. Crane Company; Crane Valve Group; Crane Valves
- b. Gulf Valve Company
- c. Valve and Primer Corporation

3. Dual-Plate, Ferrous-Alloy, Double-Flanged-Type Check Valves:

- a. Crane Company; Crane Valve Group; Crane Valves
- b. Gulf Valve Company
- c. Techno Corporation

B. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.

C. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.

D. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

2.8 BRONZE GATE VALVES

A. Manufacturers:

1. Type 1, Bronze, Nonrising-Stem Gate Valves:

- a. Crane Company; Crane Valve Group; Crane Valves
- b. Crane Company; Crane Valve Group; Stockham Division
- c. Grinnell Corporation
- d. Milwaukee Valve Company
- e. NIBCO INC.

2. Type 2, Bronze, Rising-Stem, Solid-Wedge Gate Valves:

- a. Crane Company; Crane Valve Group; Crane Valves
- b. Crane Company; Crane Valve Group; Jenkins Valves
- c. Crane Company; Crane Valve Group; Stockham Division
- d. Grinnell Corporation
- e. Milwaukee Valve Company
- f. NIBCO INC.

3. Type 3, Bronze, Rising-Stem, Split-Wedge Gate Valves:

- a. Grinnell Corporation
- b. NIBCO INC.

B. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 1, Class 125, Bronze Gate Valves: Bronze body with nonrising stem and bronze solid wedge and union-ring bonnet.

D. Type 2, Class 125, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge and union-ring bonnet.

E. Type 3, Class 125, Bronze Gate Valves: Bronze body with rising stem and bronze split wedge and union-ring bonnet.

2.9 CAST-IRON GATE VALVES

A. Manufacturers:

1. Type I, Cast-Iron, Nonrising-Stem Gate Valves:

- a. Crane Company; Crane Valve Group; Crane Valves
- b. Crane Company; Crane Valve Group; Jenkins Valves
- c. Crane Company; Crane Valve Group; Stockham Division
- d. Grinnell Corporation
- e. Milwaukee Valve Company
- f. NIBCO INC.

2. Type I, Cast-Iron, Rising-Stem Gate Valves:

- a. Crane Company; Crane Valve Group; Crane Valves
- b. Crane Company; Crane Valve Group; Jenkins Valves
- c. Crane Company; Crane Valve Group; Stockham Division
- d. Grinnell Corporation
- e. Milwaukee Valve Company
- f. NIBCO INC.

B. Cast-Iron Gate Valves, General: MSS SP-70, Type I.

C. Class 125, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc.

D. Class 125, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.

E. Class 125, NRS, All-Iron, Cast-Iron Gate Valves: Cast-iron body with cast-iron trim, nonrising stem, and solid-wedge disc.

- F. Class 125, OS&Y, All-Iron, Cast-Iron Gate Valves: Cast-iron body with cast-iron trim, rising stem, and solid-wedge disc.

2.10 BRONZE GLOBE VALVES

A. Manufacturers:

1. Type 1, Bronze Globe Valves with Metal Disc:
 - a. Crane Company; Crane Valve Group; Crane Valves
 - b. Crane Company; Crane Valve Group; Jenkins Valves
 - c. Crane Company; Crane Valve Group; Stockham Division
 - d. Grinnell Corporation
2. Type 3, Bronze Globe Valves with Renewable Seat and Metal Disc:
 - a. Crane Company; Crane Valve Group; Crane Valves
 - b. Crane Company; Crane Valve Group; Jenkins Valves
 - c. Crane Company; Crane Valve Group; Stockham Division
 - d. Grinnell Corporation

- B. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy handwheel.

- C. Type 1, Class 125, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.

- D. Type 3, Class 125, Bronze Globe Valves: Bronze body with bronze disc and renewable seat. Include union-ring bonnet.

2.11 CAST-IRON GLOBE VALVES

A. Manufacturers:

1. Type I, Cast-Iron Globe Valves with Metal Seats:
 - a. Crane Company; Crane Valve Group; Crane Valves
 - b. Crane Company; Crane Valve Group; Jenkins Valves
 - c. Crane Company; Crane Valve Group; Stockham Division
 - d. Grinnell Corporation

- B. Cast-Iron Globe Valves, General: MSS SP-85.

- C. Type I, Class 125, Cast-Iron Globe Valves: Gray-iron body with bronze seats.

2.12 CAST-IRON PLUG VALVES

A. Manufacturers:

1. Lubricated-Type, Cast-Iron Plug Valves:
 - a. Milliken Valve Company, Inc.
 - b. Nordstrom Valves, Inc.
 - c. Olson Technologies; Homestead Division

2. Nonlubricated-Type, Cast-Iron Plug Valves:

- a. General Signal; DeZurik Unit
- b. Grinnell Corporation
- c. Mueller Flow Technologies

B. Cast-Iron Plug Valves, General: MSS SP-78.

C. Class 125 or 150, lubricated-type, cast-iron plug valves.

2.13 RESILIENT-SEATED, CAST-IRON, ECCENTRIC PLUG VALVES

A. Manufacturers:

- 1. General Signal; DeZurik Unit
- 2. Milliken Valve Company

B. Resilient-Seated, Cast-Iron, Eccentric Plug Valves, **NPS 2-1/2** and Smaller: Design similar to MSS SP-108, and rated for **175 psig** minimum CWP.

1. Resilient Seating Material: Suitable for potable-water service, unless otherwise indicated.

C. Resilient-Seated, Cast-Iron, Eccentric Plug Valves, **NPS 3** and Larger: MSS SP-108, and rated for **175 psig** minimum CWP.

1. Resilient Seating Material: Suitable for potable-water service, unless otherwise indicated.

2.14 FLANGE GASKETS

A. Flange Gaskets, High Pressure (Type GCS-300 piping): Spiral wound flexitalic type gaskets per ANSI B16.20.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. 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.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. 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.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
1. Shutoff Service: Ball, butterfly valves.
 2. Throttling Service: Angle, ball, butterfly, or globe valves.
 3. Pump Discharge: Spring-loaded, lift-disc check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Domestic Water Piping: Use the following types of valves:
1. Ball Valves, **NPS 2** and Smaller: Two-piece, **600 psig** CWP rating, copper alloy.
 2. Ball Valves, **NPS 2-1/2** and Larger: Class 150, ferrous alloy.
 3. Butterfly Valves, **NPS 2-1/2** and Larger: Flanged, **150 psig** CWP rating, ferrous alloy, with EPDM liner.
 4. Gate Valves, **NPS 2-1/2** and Larger: Type I, Class 125, NRS OS&Y, bronze-mounted cast iron.
 5. Globe Valves, **NPS 2** and Smaller: Type 2, Class 125, bronze.
 6. Globe Valves, **NPS 2-1/2** and Larger: Type I, Class 125, bronze-mounted cast iron.
- D. Heating Water Piping: Use the following types of valves:
1. Ball Valves, **NPS 2** and Smaller: Two-piece, **600 psig** CWP rating, copper alloy.
 2. Ball Valves, **NPS 2-1/2** and Larger: Class 150, ferrous alloy.
 3. Butterfly Valves, **NPS 2-1/2** and Larger: Flanged, **150 psig** CWP rating, ferrous alloy, with EPDM liner.
 4. Lift Check Valves, **NPS 2** and Smaller: Type 2, Class 125, horizontal vertical, bronze.
 5. Swing Check Valves, **NPS 2** and Smaller: Type 4, Class 125, bronze.
 6. Swing Check Valves, **NPS 2-1/2** and Larger: Type II, Class 125, gray iron.
 7. Wafer Check Valves, **NPS 2-1/2** and Larger: Dual-plate, wafer-lug, Class 125 or 150, ferrous alloy.
 8. Gate Valves, **NPS 2-1/2** and Larger: Type I, Class 125, NRS OS&Y, bronze-mounted cast iron.
 9. Globe Valves, **NPS 2** and Smaller: Type 2, Class 125, bronze.
 10. Globe Valves, **NPS 2-1/2** and Larger: Type I, Class 125, bronze-mounted cast iron.
 11. Plug Valves, **NPS 2** and Larger: Class 125 or 150, lubricated-type, cast iron.
 12. Resilient-Seated, Eccentric Plug Valves, **NPS 3** and Larger: **175 psig** CWP rating, cast iron.
- E. Select valves, except wafer and flangeless types, with the following end connections:
1. For Copper Tubing, **NPS 2** and Smaller: Threaded ends.
 2. For Copper Tubing, **NPS 2-1/2 to NPS 4**: Flanged ends.
 3. For Copper Tubing, **NPS 6** and Larger: Flanged ends.
 4. For Steel Piping, **NPS 2** and Smaller: Threaded ends.
 5. For Steel Piping, **NPS 2-1/2 to NPS 4**: Flanged ends.
 6. For Steel Piping, **NPS 6** and Larger: Flanged ends.

3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.

- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install chainwheel operators on valves **NPS 4** and larger and more than **96 inches** above floor. Extend chains to **60 inches** above finished floor elevation.
- G. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

- A. Refer to Section 15050 "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 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.

END OF SECTION 22 0523

SECTION 22 0529 – HANGERS AND SUPPORTS FOR MECHANICAL

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 hangers and supports for mechanical system piping and equipment.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for materials for attaching hangers and supports to building structure.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.
- C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.
- C. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.
 - 1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pipe Hangers:
 - a. B-Line Systems, Inc.
 - b. Carpenter & Patterson, Inc.
 - c. Anvil International.
 - d. Michigan Hanger Co., Inc.
2. Channel Support Systems:
 - a. B-Line Systems, Inc.
 - b. Anvil International.
 - c. Michigan Hanger Co., Inc.; O-Strut Div.
 - d. Unistrut Corp.
3. Thermal-Hanger Shield Inserts:
 - a. Carpenter & Patterson, Inc.
 - b. Michigan Hanger Co., Inc.
 - c. Pipe Shields, Inc.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.

1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
2. Material for Cold Piping: ASTM C 552, Type I cellular glass with vapor barrier.
3. Material for Cold Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
4. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
5. Material for Hot Piping: ASTM C 552, Type I cellular glass.
6. Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate.
7. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
8. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
9. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

- A. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- B. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- C. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
 - 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 2. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 3. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification 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.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- E. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 2. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
- F. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
 - 2. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
 - 1. Field assemble and install according to manufacturer's written instructions.
- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- I. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9.
 - 2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12-inches long and 0.048-inch thick.
 - b. NPS 4: 12-inches long and 0.06-inch thick.
 - c. NPS 5 and NPS 6: 18-inches long and 0.06-inch thick.
 - d. NPS 8 to NPS 14: 24-inches long and 0.075-inch thick.
5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 Section "Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 22 0529

SECTION 22 0553 – MECHANICAL IDENTIFICATION

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 mechanical identification materials and their installation:
 - 1. Equipment nameplates and labels.
 - 2. Equipment markers.
 - 3. Equipment signs.
 - 4. Access panel and door markers.
 - 5. Pipe markers.
 - 6. Duct markers.
 - 7. Valve tags.
 - 8. Valve schedules.
 - 9. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
 - 1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 - 2. Location: Accessible and visible.
 - 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
 - 1. Terminology: Match schedules as closely as possible.
 - 2. Data:
 - a. Name and plan number.
 - b. Equipment service area.
 - c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
 - 3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

2.2 PIPING IDENTIFICATION DEVICES

- A. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- B. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

2.3 DUCT IDENTIFICATION DEVICES

- A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Architect. Provide 5/32-inch hole for fastener.
 - 1. Material: 0.032-inch- thick brass.
 - 2. Material: 0.0375-inch- thick stainless steel.
 - 3. Material: 3/32-inch- thick laminated plastic with 2 black surfaces and white inner layer.
 - 4. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

2.5 VALVE SCHEDULES

- A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
 2. Frame: Extruded aluminum.
 3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
1. Size: 3 by 5-1/4 inches minimum.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
1. Fans, blowers, primary balancing dampers, and mixing boxes.
 2. Control panels and end devices.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Meters, gages, thermometers, and similar units.
 - c. Fans, blowers, primary balancing dampers, and mixing boxes.

3.3 DUCT IDENTIFICATION

- A. Install duct markers with permanent adhesive on air ducts in the following color codes:
 - 1. Green: For cold-air supply ducts.
 - 2. Yellow: For hot-air supply ducts.
 - 3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
 - 5. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches, round.
 - b. Hot Water: 1-1/2 inches, round.
 - c. Gas: 1-1/2 inches, round.
 - 2. Valve-Tag Color:
 - a. Cold Water: Blue.
 - b. Hot Water: Red.

3.5 VALVE-SCHEDULE INSTALLATION

- A. Mount valve schedule on wall in accessible location in each major equipment room.

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

END OF SECTION 22 0553

SECTION 22 0719 – PIPE 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. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 07 Section "Firestop Systems" for firestopping materials and requirements for penetrations through fire and smoke barriers.
 - 2. Section 22 0529 "Hangers and Supports for Mechanical" for pipe insulation shields and protection saddles.
 - 3. Section 23 0713 "Duct Insulation" for insulation for ducts and plenums.

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
 - 2. Attachment and covering of heat trace inside insulation.
 - 3. Insulation application at pipe expansion joints for each type of insulation.
 - 4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Removable insulation at piping specialties and equipment connections.
 - 6. Application of field-applied jackets.
- C. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification 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 Mechanical."
- B. Coordinate clearance requirements with piping Installer for insulation application.
- C. Coordinate installation and testing of steam or electric heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.
 - d. Schuller International, Inc.
 - 2. Flexible Elastomeric Thermal Insulation:
 - a. Armstrong World Industries, Inc.
 - b. Rubatex Corp.

2.2 INSULATION MATERIALS

- A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
 - 1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
 - 2. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
 - 3. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
 - a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
 - b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
 - 4. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
 - 5. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
 - 6. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.

7. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- B. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 1. Adhesive: As recommended by insulation material manufacturer.
 2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.
- C. Calcium Silicate Insulation: Preformed pipe sections of noncombustible, inorganic, hydrous calcium silicate with a nonasbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
- D. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
- C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.
 1. Adhesive: As recommended by insulation material manufacturer.
 2. PVC Jacket Color: White or gray.
 3. PVC Jacket Color: Color-code piping jackets based on materials contained within the piping system.
- D. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- thick, high-impact, ultraviolet-resistant PVC.
 1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
 2. Adhesive: As recommended by insulation material manufacturer.
- E. Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209, 3003 alloy, H-14 temper.
- F. Aluminum Jacket: Aluminum stucco-embossed finish roll stock, ready for shop or field cutting and forming to indicated sizes. Comply with ASTM B 209, 3003 alloy, H-14 temper.
 1. Finish and Thickness: Stucco-embossed finish, 0.016-inch thick.
 2. Moisture Barrier: 1-mil thick, heat-bonded polyethylene and kraft paper.
 3. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.

2.4 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd.
 1. Tape Width: 4-inches.

- B. Bands: 3/4-inch wide, in one of the following materials compatible with jacket:
 - 1. Aluminum: 0.007-inch thick.
- C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

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.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply 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. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- H. Keep insulation materials dry during application and finishing.
- I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- J. Apply insulation with the least number of joints practical.
- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
 - 1. Apply insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12-inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
 - 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- O. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Circumferential Joints: Cover with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4-inches o.c.
 - 3. Longitudinal Seams: Overlap jacket seams at least 1-1/2-inches. Apply 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 4-inches o.c.
 - a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
 - 4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
 - 5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.
- P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
 - 1. Seal penetrations with vapor-retarder mastic.
 - 2. Apply insulation for exterior applications tightly joined to interior insulation ends.
 - 3. Extend metal jacket of exterior insulation outside roof flashing at least 2-inches below top of roof flashing.
 - 4. Seal metal jacket to roof flashing with vapor-retarder mastic.
- Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.
- R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.
- S. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Firestopping and fire-resistive joint sealers are specified in Division 07 Section "Firestop Systems."
- T. Floor Penetrations: Apply insulation continuously through floor assembly.
 - 1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
 2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.
 3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6-inches o.c.
 4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.
- B. Apply insulation to flanges as follows:
1. Apply preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1-inch, and seal joints with vapor-retarder mastic.
- C. Apply insulation to fittings and elbows as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
 3. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1-inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
- D. Apply insulation to valves and specialties as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For strainers, arrange insulation for access to strainer basket without disturbing insulation.
 3. Apply insulation to flanges as specified for flange insulation application.
 4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
 5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
1. Follow manufacturer's written instructions for applying insulation.
 2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

D. Apply insulation to valves and specialties as follows:

1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to strainer basket.
3. Apply insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.

1. Draw jacket material smooth and tight.
2. Apply lap or joint strips with the same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Apply jackets with 1-1/2-inch laps at longitudinal seams and 3-inch wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

C. Apply PVC jacket where indicated, with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

D. Apply metal jacket where indicated, with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12-inches o.c. and at end joints.

3.7 FINISHES

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 09 Section "Painting (Professional Line Products)."
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.8 PIPING SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
 - 1. Flexible connectors.
 - 2. Vibration-control devices.
 - 3. Fire-suppression piping.
 - 4. Below-grade piping, unless otherwise indicated.
 - 5. Chrome-plated pipes and fittings, unless potential for personnel injury.
 - 6. Air chambers, unions and flow regulators.

3.9 FIELD QUALITY CONTROL

- A. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
 - 1. Inspect fittings and valves randomly selected by Architect/Engineer.
- B. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.
- C. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

3.10 INSULATION APPLICATION SCHEDULE, GENERAL

- A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.
- B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.11 INTERIOR INSULATION APPLICATION SCHEDULE

- A. Service: Domestic hot, recirculated hot water and tempered water.
 - 1. Operating Temperature: 60 to 140 deg F.
 - 2. Insulation Material: Mineral fiber.

3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Copper Pipe, 1" and less: 3/4-inch thick.
 - b. Copper Pipe, 1-1/4" to 2": 1-inch thick.
 - c. Copper, Galvanized Pipe, 2-1/2" to 6": 1-inch thick.
 4. Field-Applied Jacket: None.
 5. Vapor Retarder Required: No.
 6. Finish: None.
- B. Service: Domestic cold water.
1. Operating Temperature: 35 to 60 deg F.
 2. Insulation Material: Mineral fiber.
 3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Copper Pipe, 1" to 2": 1-inch thick.
 - b. Copper, Steel Pipe, 2-1/2" and larger: 1-inch thick.
 - c. Copper Galvanized Pipe, 2-1/2" to 6": 2-inches thick.
 4. Field-Applied Jacket: Foil and paper.
 5. Vapor Retarder Required: Yes.
 6. Finish: None.

END OF SECTION 22 0719

SECTION 22 1101 - HYDRONIC PIPING AND SPECIALTIES

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 piping, special-duty valves, and hydronic specialties for hot-water heating and chilled-water cooling; makeup water for these systems; blowdown drain lines; and condensate drain piping.
- B. Related Sections include the following:
 - 1. Section 07 8413 "Through-Penetration Firestop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.
 - 2. Section 07 9200 "Joint Sealants" for materials and methods for sealing pipe penetrations through exterior walls.
 - 3. Section 22 0510 "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
 - 4. Section 22 0529 "Hangers and Supports" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
 - 5. Section 22 0553 "Mechanical Identification" for labeling and identifying hydronic piping.
 - 6. Section 22 0519 "Meters and Gages" for thermometers, flow meters, and pressure gages.
 - 7. Section 22 0523 "Valves" for general-duty gate, globe, ball, butterfly, and check valves.
 - 8. Section 23 0900 "HVAC Instrumentation and Controls" for temperature-control valves and sensors.

1.3 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride.
- B. PVC: Polyvinyl chloride.

1.4 SUBMITTALS

- A. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.
- B. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion loops, and their attachment to the building structure. Detail location of anchors, alignment guides, and loops.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.
- D. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Failed test results and corrective action taken to achieve requirements.
- E. Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in Division 1.

- F. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

1.6 COORDINATION

- A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate pipe sleeve installations for foundation wall penetrations.
- C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.
- D. Coordinate pipe fitting pressure classes with products specified in related Sections.
- E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.
- F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Section 07 8413 "Through-Penetration Firestop Systems" for fire and smoke wall and floor assemblies.

1.7 EXTRA MATERIALS

- A. Water Treatment Chemicals: Furnish sufficient chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Calibrated Balancing Valves:
 - a. ITT Bell & Gossett; ITT Fluid Technology Corporation
 - b. Taco, Inc.
 - c. Flow Design
 2. Safety Valves:
 - a. Conbraco Industries, Inc.
 - b. ITT McDonnell & Miller Division; ITT Fluid Technology Corporation
 - c. Kunkle Valve Division
 - d. Spence Engineering Company, Inc.

3. Expansion Tanks:
 - a. Amtrol, Inc.
 - b. ITT Bell & Gossett; ITT Fluid Technology Corporation
 - c. Taco, Inc.
4. Air Separators and Air Purgers:
 - a. Amtrol, Inc.
 - b. ITT Bell & Gossett; ITT Fluid Technology Corporation
 - c. Taco, Inc.
5. AHU and Pipe Mains Automatic Air Vents:
 - a. Hoffman, model #78
6. Hydraulic Hose:
 - a. Gates Hydraulic
 - b. Approved equal

2.2 PIPING MATERIALS

- A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.3 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: **ASTM B 88, Type L.**
- B. Annealed-Temper Copper Tubing: **ASTM B 88, Type K.**
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Wrought-Copper Fittings: ASME B16.22.
- E. Wrought-Copper Unions: ASME B16.22.
- F. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.
- G. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

2.4 STEEL PIPE AND FITTINGS

- A. Steel Pipe, **NPS 2** and Smaller: ASTM A 53, Type S (seamless) or Type F (furnace-butt welded), Grade A, Schedule 40, black steel, plain ends.
- B. Steel Pipe, **NPS 2-1/2 through NPS 12**: ASTM A 53, Type E (electric-resistance welded), Grade A, Schedule 40, black steel, plain ends.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced.

- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.
- H. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150 psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4 inch misalignment.
- I. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body with steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 250 deg F and pressures up to 150 psig.
- J. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.
- K. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.5 VALVES

- A. Gate, globe, check, ball, and butterfly valves are specified in Section 22 0523 "Valves."
- B. Refer to Part 3 "Valve Applications" Article for applications of each valve.
- C. Calibrated Balancing Valves, NPS 2 and Smaller: Bronze body, ball type, 125 psig working pressure, 250 deg F maximum operating temperature, and having threaded ends. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.
- D. Calibrated Balancing Valves, NPS 2-1/2 and Larger: Cast-iron or steel body, ball type, 125 psig working pressure, 250 deg F maximum operating temperature, and having flanged or grooved connections. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.
- E. Safety Valves: Diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV.

2.6 HYDRONIC SPECIALTIES

- A. Manual Air Vent: Bronze body and nonferrous internal parts; 150 psig working pressure; 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 discharge connection and NPS 1/2 inlet connection.
- B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150 psig working pressure; 240 deg F operating temperature; with NPS 1/4 discharge connection and NPS 1/2 inlet connection.
- C. Y-Pattern Strainers: 125 psig working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2 and larger, threaded connections for NPS 2 and smaller, bolted cover, perforated stainless-steel basket, and bottom drain connection.

- D. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150 psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged- or threaded-end connections to match equipment connected and shall be capable of 3/4 inch misalignment.
- E. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body with steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 250 deg F and pressures up to 150 psig.
- F. Expansion Tanks: Welded carbon steel, rated for 125 psig working pressure and 375 deg F maximum operating temperature. Separate air charge from system water to maintain design expansion capacity by a flexible bladder securely sealed into tank. Include drain fitting and taps for pressure gage and air-charging fitting. Support vertical tanks with steel legs or base. Factory fabricate and test tank with taps and supports installed and labeled according to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
- G. In-Line Air Separators: One-piece cast iron with an integral weir designed to decelerate system flow to maximize air separation at a working pressure up to 175 psig and liquid temperature up to 300 deg F.
- H. T-Pattern Strainers: 750 psig working pressure; ductile-iron or malleable-iron body, grooved-end connections, stainless-steel basket with 57 percent free area; removable access coupling and end cap for strainer maintenance.
- I. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150 psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged- or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.
- J. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body with steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 250 deg F and pressures up to 150 psig.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Hot Water and Chilled Water, NPS 2 and Smaller: Aboveground, use Type L drawn-temper copper tubing with soldered joints or Schedule 40 steel pipe with threaded joints. Belowground or within slabs, use Type K annealed-temper copper tubing without joints.
- B. Hot Water and Chilled Water, NPS 2-1/2 and Larger: Schedule 40 steel pipe with welded and flanged joints.
- C. Condensate Drain Lines: Type L drawn-temper copper tubing with soldered joints.

3.2 VALVE APPLICATIONS

- A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:
 - 1. Shutoff Duty: Gate, ball, and butterfly valves.
 - 2. Throttling Duty: Globe, ball, and butterfly valves.
- B. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.

- C. Install calibrated balancing valves in the return water line of each heating or cooling element and elsewhere as required to facilitate system balancing.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install safety valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.

3.3 PIPING INSTALLATIONS

- A. Refer to Section 22 0510 "Basic Mechanical Materials and Methods" for basic piping installation requirements.
- B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- C. Install drains, consisting of a tee fitting, **NPS 3/4** ball valve, and short **NPS 3/4** threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- D. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- E. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- F. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.
- G. Install strainers on supply side of each air handling unit control valve, in-line pump, and elsewhere as indicated. Install **NPS 3/4** nipple and ball valve in blowdown connection of strainers **NPS 2** and larger. Match size of strainer blowoff connection for strainers smaller than **NPS 2**.
- H. Anchor piping for proper direction of expansion and contraction.

3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Section 22 0529 "Hangers and Supports." Comply with requirements below for maximum spacing of supports.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than **20 feet** long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping **20 feet** or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping **20 feet** or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 - 1. **NPS 3/4**: Maximum span, **7 feet**; minimum rod size, **1/4 inch**.
 - 2. **NPS 1**: Maximum span, **7 feet**; minimum rod size, **1/4 inch**.
 - 3. **NPS 1-1/2**: Maximum span, **9 feet**; minimum rod size, **3/8 inch**.
 - 4. **NPS 2**: Maximum span, **10 feet**; minimum rod size, **3/8 inch**.
 - 5. **NPS 2-1/2**: Maximum span, **11 feet**; minimum rod size, **3/8 inch**.
 - 6. **NPS 3**: Maximum span, **12 feet**; minimum rod size, **3/8 inch**.
 - 7. **NPS 4**: Maximum span, **14 feet**; minimum rod size, **1/2 inch**.
 - 8. **NPS 6**: Maximum span, **17 feet**; minimum rod size, **1/2 inch**.

- D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. **NPS 3/4:** Maximum span, **5 feet**; minimum rod size, **1/4 inch**.
 2. **NPS 1:** Maximum span, **6 feet**; minimum rod size, **1/4 inch**.
 3. **NPS 1-1/2:** Maximum span, **8 feet**; minimum rod size, **3/8 inch**.
 4. **NPS 2:** Maximum span, **8 feet**; minimum rod size, **3/8 inch**.
 5. **NPS 2-1/2:** Maximum span, **9 feet**; minimum rod size, **3/8 inch**.
 6. **NPS 3:** Maximum span, **10 feet**; minimum rod size, **3/8 inch**.
- E. Support vertical runs at each floor, and at **10-foot** intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

- A. Refer to Section 22 0510 "Basic Mechanical Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded, and flanged joints in steel piping.

3.6 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.
- C. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- D. Install automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.
- E. Install dip-tube fittings in boiler outlet. Install piping to expansion tank with a 2 percent upward slope toward tank. Connect boiler-outlet piping.
- F. Install in-line air separators in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install drain valve on units **NPS 2** and larger.
- G. Install expansion tanks on floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system design requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Size for supply and return piping connections shall be same as for equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install ports for pressure and temperature gages at coil inlet connections.

3.8 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 3. Flush system with clean water. Clean strainers.

4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
3. Check expansion tanks to determine that they are not air bound and that system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

3.9 ADJUSTING

- A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.
- B. Perform these adjustments before operating the system:
1. Open valves to fully open position. Close coil bypass valves.
 2. Check pump for proper direction of rotation.
 3. Set automatic fill valves for required system pressure.
 4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
 5. Set temperature controls so all coils are calling for full flow.
 6. Check operation of automatic bypass valves.
 7. Check and set operating temperatures of boilers, chillers, and cooling towers to design requirements.
 8. Lubricate motors and bearings.

3.10 CLEANING

- A. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

END OF SECTION 22 1101

SECTION 22 1116 – 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. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.
- B. Related Sections include the following:
 - 1. Section 22 4100 "Plumbing Specialties" for water distribution piping specialties.

1.3 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. PA: Polyamide (nylon) plastic.
- C. PE: Polyethylene plastic.
- D. PEX: Crosslinked polyethylene plastic.
- E. PP: Polypropylene plastic.
- F. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Domestic Water Distribution Piping: **125 psig**.

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Samples: Specified in "Cleaning" Article in Part 3.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 STEEL PIPING

- A. Steel Pipe: ASTM A 53, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
 3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.

2.3 COPPER TUBING

- A. Soft Copper Tube: **ASTM B 88, Types K and L**, water tube, annealed temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- B. Hard Copper Tube: **ASTM B 88, Types L and M**, water tube, drawn temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
 4. Copper, Grooved-End Fittings: **ASTM B 75** copper tube or ASTM B 584 bronze castings.
 - a. Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

2.4 VALVES

- A. Refer to Division 22 0523 Section "General Duty Valves" for bronze and cast-iron, general-duty valves.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- 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 may be used on aboveground piping, unless otherwise indicated.

- C. Grooved joints may be used on aboveground grooved-end piping.
- D. Fitting Option: Mechanically formed tee-branch outlets and brazed joints may be used on aboveground copper tubing.
- E. Underground Domestic Water Service Piping: Use the following piping materials for each size range:
 - 1. **NPS 2** and Smaller: Soft copper tube, Type L; copper pressure fittings; and soldered joints.
- F. Aboveground Domestic Water Piping: Use the following piping materials for each size range:
 - 1. **NPS 1-1/2** and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 2. **NPS 2**: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 3. **NPS 2-1/2 to NPS 3-1/2**: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 4. **NPS 2-1/2 to NPS 3-1/2**: Use **NPS 2-1/2 to NPS 4** hard copper tube, Type L with grooved ends; copper grooved-end fittings; copper-tubing, keyed couplings; and grooved joints.
 - 5. **NPS 4 to NPS 6**: Steel pipe; gray-iron, threaded fittings; and threaded joints.
 - 6. **NPS 4 to NPS 6**: Steel pipe with grooved ends; steel-piping, grooved-end fittings; steel-piping, keyed couplings; and grooved joints.
 - 7. **NPS 4 to NPS 6**: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 8. **NPS 4 to NPS 6**: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; copper-tubing, keyed couplings; and grooved joints.

3.2 PIPING INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Install underground copper tubing according to CDA's "Copper Tube Handbook."
- C. Install aboveground domestic water piping level without pitch and plumb.
- D. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
- E. Perform the following steps before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
 - 5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 6. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

3.3 JOINT CONSTRUCTION

- A. Refer to Section 22 0510 "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- C. Grooved Joints: Assemble joints with keyed-coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 22 Section "Hangers and Supports for Mechanical" for pipe hanger and support devices. Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. **100 Feet** and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than **100 Feet**: MSS Type 43, adjustable roller hangers.
 - c. Longer Than **100 Feet**, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs **100 Feet** or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Mechanical."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of **3/8 inch**.
- E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. **NPS 1-1/4** and Smaller: **84 inches** with **3/8-inch** rod.
 - 2. **NPS 1-1/2**: **108 inches** with **3/8-inch** rod.
 - 3. **NPS 2**: **10 feet** with **3/8-inch** rod.
 - 4. **NPS 2-1/2**: **11 feet** with **1/2-inch** rod.
 - 5. **NPS 3** and **NPS 3-1/2**: **12 feet** with **1/2-inch** rod.
 - 6. **NPS 4** and **NPS 5**: **12 feet** with **5/8-inch** rod.
- F. Install supports for vertical steel piping every **15 feet**.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. **NPS 3/4** and Smaller: **60 inches** with **3/8-inch** rod.
 - 2. **NPS 1** and **NPS 1-1/4**: **72 inches** with **3/8-inch** rod.
 - 3. **NPS 1-1/2** and **NPS 2**: **96 inches** with **3/8-inch** rod.
 - 4. **NPS 2-1/2**: **108 inches** with **1/2-inch** rod.
 - 5. **NPS 3 to NPS 5**: **10 feet** with **1/2-inch** rod.
- H. Install supports for vertical copper tubing every **10 feet**.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.

- C. Connect domestic water piping to service piping with shutoff valve, and 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. Refer to Division 22 Section "Plumbing Fixtures."
 - 2. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for **NPS 2-1/2** and larger.

3.6 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
 - 1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
 - 2. 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:
 - 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 for final inspection by 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 test or inspection, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping 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 domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Cap and subject piping to static water pressure of **50 psig** above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 - 5. Prepare reports for tests and required corrective action.

3.7 ADJUSTING

- A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - 1. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
 - 2. Adjust calibrated balancing valves to flows indicated.

3.8 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as 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. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 22 1116

SECTION 22 1316 - 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 soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.
- B. Related Sections include the following:
 - 1. Section 22 4100 "Plumbing Specialties" for soil, waste, and vent piping systems specialties.

1.3 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. EPDM: Ethylene-propylene-diene terpolymer.
 - 3. NBR: Acrylonitrile-butadiene rubber.
 - 4. PE: Polyethylene plastic.
 - 5. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings: For solvent drainage system, include plans, elevations, sections, and details.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

- C. Transition Couplings for Underground Pressure Piping: AWWA C219 metal, sleeve-type coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 CAST-IRON SOIL PIPING

- A. Manufacturers:

- 1. Tyler.
- 2. Charlotte.
- 3. AB & I
- 4. U.S.A. made.

- B. Hubless Pipe and Fittings: ASTM A 888 and CISPI 301.

- 1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.
 - a. Heavy-Duty, Type 301, Stainless-Steel Couplings: ASTM A 666, Type 301, stainless-steel shield; stainless-steel bands; and sleeve.
 - 1) NPS 1-1/2 to NPS 4: 3-inch wide shield with 4 bands.
 - 2) NPS 5 to NPS 10: 4-inch wide shield with 6 bands.
- 2. Solvent Fittings: ASME B16.45 or ASSE 1043, hubless, aerator and deaerator.

2.3 COPPER TUBING

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

- 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

- B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.

- 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
- 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
- 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.4 PVC PIPING (UNDERGROUND ONLY)

- A. PVC Pipe: ASTM D 2665, solid-wall drain.

- 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:
 - 1. NPS 1-1/4 and NPS 1-1/2: Use NPS 1-1/2 hubless, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 301, stainless steel.
 - b. Couplings: Heavy-duty, FM approved.
 - c. Couplings: Compact, stainless steel.
 - 2. NPS 1-1/4 and NPS 1-1/2: Copper DWV tube, copper drainage fittings, and soldered joints.
 - 3. NPS 2 to NPS 4: Hubless, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 301, stainless steel.
 - b. Couplings: Heavy-duty, FM approved.
 - c. Couplings: Compact, stainless steel.
- D. Underground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:
 - 1. NPS 2 to NPS 4: Hubless, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 301, stainless steel.
 - b. Couplings: Heavy-duty, FM approved.
 - c. Couplings: Compact, stainless steel.
 - 2. NPS 2 to NPS 4: PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 3. NPS 5 and NPS 6: Hubless, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 301, stainless steel.
 - b. Couplings: Heavy-duty, FM approved.
 - c. Couplings: Compact, stainless steel.
 - 4. NPS 5 and NPS 6: PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 5. NPS 8 and NPS 10: Hubless, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 301, stainless steel.
 - b. Couplings: Heavy-duty, FM approved.
 - c. Couplings: Compact, stainless steel.
 - 6. NPS 8 and NPS 10: PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 7. NPS 12: PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.3 PIPING INSTALLATION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.

- B. Underground, Ductile-Iron, Force-Main Piping: Comply with AWWA C600. Install buried piping inside the building between wall and floor penetrations and connection to sanitary sewer piping outside the building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
 - 1. Encase piping with PE film according to ASTM A 674 or AWWA C105.
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.
- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for wall penetration systems.
- E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Encase underground piping with PE film according to ASTM A 674 or AWWA C105.
- F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- H. 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.
- I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- J. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- K. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- D. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- E. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Refer to Section 22 0529 "Hangers and Supports for Mechanical" for pipe hanger and support devices. Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Mechanical."
- 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 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: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
 - 6. NPS 15: 60 inches with 1-inch rod.
 - 7. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install supports for vertical steel piping every 15 feet.
- H. Install supports for vertical stainless-steel piping every 10 feet.

- I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 5. NPS 6: 10 feet with 5/8-inch rod.
 - 6. NPS 8: 10 feet with 3/4-inch rod.
- J. Install supports for vertical copper tubing every 10 feet.

3.6 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. Refer to Division 22 Section "Plumbing Fixtures."
 - 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. Refer to Division 22 Section "Plumbing Specialties."
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 1316

SECTION 22 4000 – 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 plumbing fixtures and related components.
- B. Related Sections include the following:
 - 1. Section 22 4100 "Plumbing Specialties" for backflow preventers and specialty fixtures not in this Section.

1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, showerheads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.4 SUBMITTALS

- A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act" and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.

- E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
 - 2. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
 - 3. Vitreous-China Fixtures: ASME A112.19.2M.
 - 4. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
- I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - 4. Faucet Hose: ASTM D 3901.
 - 5. Faucets: ASME A112.18.1M.
 - 6. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 7. Hose-Coupling Threads: ASME B1.20.7.
 - 8. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 9. NSF Materials: NSF 61.
 - 10. Pipe Threads: ASME B1.20.1.
 - 11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 - 12. Supply and Drain Fittings: ASME A112.18.1M.
- J. 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 A112.18.1M.
 - 3. Manual-Operation Flushometers: ASSE 1037.
 - 4. Plastic Tubular Fittings and Piping: ASTM F 409.
 - 5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
 - 6. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.
- K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Floor Drains: ASME A112.21.1M.
 - 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.

1.6 COORDINATION

- A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. For fixture descriptions in other Part 2 articles where the subparagraph title "Manufacturers" introduce a list of manufacturers and their products or manufacturers only, the following requirements apply for product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in other Part 2 articles.

2.2 FLUSHOMETERS

- A. Flushometer, FM-1: Exposed, sensor activated Royal model water closet flushometer for floor mounted or wall hung top spud bowls.
1. Manufacturers: Sloan Royal Optima, model 111-1.6ES-S.
 2. Quiet, exposed, diaphragm type, chrome plated closet flushometer with the following features:
 - a. Permex symthetic rubber diaphragm with dual filtered fixed bypass.
 - b. Handle packing, main seat, stop seat and vacuum breaker moded from Permex rubber compound for chloramines resistance.
 - c. Three (3) second flush delay.
 - d. Sweat solder adapter with cover tube and cast wall flange with set screw.
 - e. Optima EL-1500 self-adaptive infrared sensor with indicator light.
 - f. Die cast sensor plate with no visible fasteners.
 - g. High back pressure vacuum breaker flush connection with one-piece bottom hex coupling nut, spud coupling and flange for 1-1/2" top spud.
 - h. Non-hold open integral solenoid operator, fixed metering bypass and no external volume adjustment.
 - i. Courtesy flush override button.
 - j. 1" IPS screwdriver bak-check angle stop with free spinning vandal resistant stop cap.
 3. Valve body, cover, tailpiece and control stop shall be in conformance with ASTM Alloy Classification for Semi-Red Brass.
 4. Valve shall be in compliance with the applicable sections of ASSE 1037 and ANSI/ASME 112.19.2.
 5. Consumption: Override flush button or sensor activated; 1.28 gpf/4.8 lpf)
 6. Warranty: 3 year.
 7. Electrical Specifications:
 - a. Control Circuit:
 - 1) Solid state
 - 2) Three (3) second flush delay
 - 3) 24 VAC input.
 - 4) 24 VAC output.
 - 5) 16 second arming delay
 - b. Sensor Range:
 - 1) Nominal 22" - 42" (559mm - 1067mm) self-adaptive window, $\pm 10"$ (254mm).
 - c. Solenoid Operator:
 - 1) 24 VAC, 50/60 Hz.

d. Transformers:

- 1) Sloan model EL-154, 120 VAC, 50/60 Hz primary, 24 VAC, 50/60 Hz secondary, Class II, UL listed, 50 VA.
- 2) Sloan model EL-342, 240 VAC, 50/60 Hz primary, 24 VAC, 50/60 Hz secondary, Class II, UL listed, 50 VA.

e. Accessories:

- 1) Sloan model EL-154, 120 VAC/24 VAC, 50/60 Hz (50 VA), box mount
- 2) Transformer (240 VAC/24 VAC, 50 VA), Sloan model EL-342

B. Flushometer, FM-2: Exposed, sensor activated Royal model urinal flushometer for 3/4" top spud urinal flushometer.

1. Manufacturers: Sloan Royal Optima sensor activated flushometers, model 186-1.0ES-S.
2. Quiet, exposed, dual filtered diaphragm assembly, chrome plated urinal flushometer with the following features:
 - a. Swat solder adapter with cover tube and cast wall flange with set screw.
 - b. Optima EL-1500 self-adaptive infrared sensor with indicator light.
 - c. Non-hold open integral solenoid operator, fixed metering bypass and no external volume adjustment.
 - d. High back pressure vacuum breaker flush connection with one-piece bottom hex coupling nut, spud coupling and flange for 3/4" top spud.
 - e. Stop seat and vacuum breaker molded from Permex rubber compound for chloramines resistance.
 - f. 3/4" IPS screwdriver back-check angle stop with vandal resistant stop cap.
 - g. Infrared sensor with multiple-focused, lobular sensing fields for high and low target detection.
 - h. 8 second arming delay.
 - i. 24 VAC input.
 - j. 24 VAC output.
 - k. Solenoid Operator: 24 VAC, 50/60 Hz.
 - l. Sensor Range: Nominal 15" - 30" (381mm - 762mm), adjustable $\pm 8"$ (203mm).
3. Valve body, cover, tailpiece and control stop shall be in conformance with ASTM Alloy Classification for Semi-Red Brass.
4. Valve shall be in compliance with the applicable sections of ASSE 1037 and ANSI/ASME 112.19.2.
5. Consumption: 0.25 gpf/1.0 lpf.
6. Warranty: 3 year.

2.3 TOILET SEATS

A. Toilet Seat, TS-1: Solid plastic.

1. Manufacturers: Olsonite, Church, Kohler, Centoco, Bemis.
2. Configuration: Open front without cover.
3. Size: Elongated.
4. Class: Heavy-duty commercial.
5. Color: White.

2.4 FIXTURE SUPPORTS

- A. Urinal Support, UR-1: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include steel uprights with feet.
 - 1. Manufacturers:
 - a. J. R. Smith 0637
 - b. Approved equal
 - 2. Accessible Fixture Support: Include rectangular steel uprights.

2.5 WATER CLOSETS

- A. Water Closets, WC-1: Floor mounting, bottom outlet, vitreous china fixture designed for flushometer valve operation. ADA compliant.
 - 1. Manufacturers:
 - a. Sloan, model no. ST-2029
 - 2. Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
 - 3. Height: Standard, barrier free accessible.
 - 4. Color: White.
 - 5. Supply: NPS 1-1/2" chrome plated brass or chrome plated copper with loose-key stop.
 - 6. Toilet Seat: TS-1.
 - 7. Water Closet Floor Flange:
 - a. Josam Company
 - b. Smith, Jay R. Mfg. Co.
 - c. Tyler Pipe; Wade Div.

2.6 URINALS

- A. Urinals, UR-1: Wall-hanging, back-outlet, vitreous-china fixture designed for flushometer valve operation.
 - 1. Products:
 - a. Sloan; SU-1009-0.25
 - 2. Strainer or Trapway: Separate removable strainer with integral trap.
 - 3. Design Consumption: .25 gpf.
 - 4. Color: White.
 - 5. Supply Spud Size: **NPS 3/4**.
 - 6. Outlet Size: **NPS 2**.
 - 7. Flushometer: FM-2.
 - 8. Fixture Support: Urinal chair carrier.

2.7 LAVATORIES

- A. Lavatories, L-1.
 - 1. Products: Acorn, Wash-Ware 3644-2-SO Series Corterra Quad-Lav, four (4) stations, ADA compliant.

- a. Bowl, spray head and pedestal side panels are constructed of Corterra recycled solid surface polymer resin (with aluminum trihydrate and other fillers) and conform with ANSI Z124.3 and Z124.6 load ratings and is ICPA SS-1 approved. Bowl is 46" (1168mm) wide and includes backsplash and spray head. Spray head includes access cover and vandal-resistant spray nozzles. Bowl includes grid strainer and tail piece.
 - b. Pedestal housing features Corterra side panels and a heavy gauge, stainless steel front access panel with vandal-resistant fasteners. The standard height 4-station Corterra Quad-Lav wash fountain conforms to all ANSI, UFAS and ADA requirements.
 - c. Sectional Control: One sensor actuates one station.
 - d. Electronic sensor operation shall include individual solenoid valves activated by infrared sensors. A plug-in style transformer shall be provided with unit.
 - e. Spray nozzles shall be vandal-resistant and provide a concentrated spray of 0.5 GPM at each station.
 - f. Hot and Cold Supplies: Provide with an ASSE 1070 compliant temperature/pressure balancing mixing valve with integral checks and strainers. A minimum of 30 psi supply pressure is required.
 - g. Provide and install Corterra Quad-Lav wash fountain. Bowl, spray head and pedestal side panels to be constructed of Corterra recycled solid surface polymer resin (with aluminum trihydrate and other fillers) and shall conform to ANSI Z124.3 and Z124.6 (specify color). Unit with 34" standard height rim to conform to ANSI, UFAS and ADA accessibility standards. Provide an ASSE 1070 compliant temperature/pressure balancing mixing valve with integral checks and strainers in hot and cold supply and field set water temperature at 105 degrees Fahrenheit. Provide grid strainer and waste tailpiece. Operation: Provide individual solenoid valves activated by infrared sensors with plug-in transformer. Spray nozzles shall be vandal-resistant with 0.5 GPM flow controls.
2. Corterra 4-station tri-lav, model 3644-2-SO
 3. Fixture Mounting and Waste: On-floor, wall outlet.
 4. Operation: Sensor
 5. Color: By Architect.
 6. Options: Single temperature supply.
 7. Manufacturers:
 - a. Acorn 3644-2-SO
 - b. Bradley MF2944

2.8 SPECIAL PLUMBING FIXTURES

- A. Toilet Room Mixing Faucet, WH-1: Shall be encased hot and cold wall hydrant with top feed for narrow wall installation. Hydrant shall have bronze body, brass interior parts, replaceable seat washers, screwdriver operated stops handle operated valves, 3/4" male hose connection with vacuum breaker, stainless steel box with removable hinged cover with cylinder lock. Provide with mounting hardware.
 1. Manufacturers:
 - a. J. R. Smith, model 5518
 - b. Zurn
 - c. T & S Brass & Bronze Works, Inc.

2.9 ACCESSORIES

- A. Supply Tubes, Stop Valves, and Escutcheons for Faucets: Sweat, threaded or compression connection. Rigid supplies. Valves and escutcheons chrome plated brass where exposed, may be rough brass where concealed. Supply tubes chrome plated brass. Brass tubes NSF/ANSI-61-G listed as $\leq 0.25\%$ weighted average lead content.

- B. Stop valves shall be quarter turn type with chrome plated body and metal handle, brass alloy body, stem and ball, PTFE seats, viton and nitrile stem seal, NSF/ANSI 61 and NSF/ANSI 372 compliant.

1. Manufacturer:

- a. Watts.
- b. Chicago.
- c. BrassCraft KT Series.
- d. Faucet manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

- A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
 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-hanging fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-hanging fixtures with tubular waste piping attached to supports.
- F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- G. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
- H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Refer to Division 22 Section "Valves" for general-duty valves.
- I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

- K. 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.
- L. Install toilet seats on water closets.
- M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- O. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- Q. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for escutcheons.

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 water supplies from water distribution piping to fixtures.
- C. Connect drain piping from fixtures to drainage piping.
- D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.
- E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.
- F. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Verify that installed fixtures are categories and types specified for locations where installed.
- B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed 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 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.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4000

SECTION 22 4100 – PLUMBING 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 plumbing specialties:

1. Water tempering valves.
2. Inline floor drain trap sealer.
3. Miscellaneous piping specialties.
4. Cleanouts.
5. Floor drains.

1.3 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PE: Polyethylene plastic.
3. PUR: Polyurethane plastic.
4. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 125 psig.
2. Sanitary Waste and Vent Piping: 10-foot head of water.

1.5 SUBMITTALS

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:

1. Thermostatic water mixing valves.
2. Water hammer arresters, air vents, and trap seal primer valves and systems.

- B. Shop Drawings: Diagram power, signal, and control wiring.

- C. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Thermostatic water mixing valves and water tempering valves.
2. Trap seal primer valves and systems.
3. Hose stations and hydrants.

1.6 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.
- E. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
 - 2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

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. Operating Key Handles: Equal to 100 percent of amount installed for each key-operated hose bibb and hydrant installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 WATER TEMPERING VALVES

- A. Manufacturers:
 - 1. Symmons
 - 2. Acorn
 - 3. Watts Industries, Inc.; Water Products Div
- B. General: Manually adjustable, thermostatically controlled water tempering valve; bronze body; and adjustable temperature setting.
- C. System Water Tempering Valves: Piston or discs controlling both hot- and cold-water flow, capable of limited antiscald protection. Include threaded inlets and outlet.
 - 1. Finish: Rough bronze.
- D. Limited-Volume, Water Tempering Valves: Solder-joint inlets and NPS 3/4 maximum outlet.

2.3 INLINE FLOOR DRAIN TRAP SEALER

- A. Manufacturers:
 - 1. Jay R. Smith 2692 size per pipe size
- B. Quad close seal trap. Approved ASSE Standard 1072 and IAPMO listed 7479. Holds up to 10" of back pressure.

2.4 MISCELLANEOUS PIPING SPECIALTIES

- A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.
 - 1. Manufacturers:
 - a. MIFAB Manufacturing, Inc.
 - b. Josam Co.
 - c. Watts Industries, Inc.; Drainage Products Div.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Jay R. Smith

2.5 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Guard, Barrier Free/BF PSG-1: Manufactured, provide ADA compliant undercounter protective covers on all supply and waste piping for all wall mounted lavatories. Covers shall be UV protected PVC, with reusable fastening system. Provide product type designed for the specific piping material over which it will be applied, Protective Shielding Guard must meet ASTM E 84 (Flame and Smoke).
 - 1. Manufacturers:
 - a. IPS Corporation True Bro, "Lav-Guard"
 - b. Zurn

2.6 CLEANOUTS

- A. Cleanouts: Comply with [ASME A112.36.2M] [ASME A112.3.1] <Insert other>.
 - 1. Application: Floor cleanout and wall cleanout.
 - 2. Products:
 - a. MIFAB Manufacturing, Inc. C1220
 - b. Josam Co.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe, Wade Div.
 - e. Watts Industries, Inc., Drainage Products Div.
 - 3. Body or Ferrule Material: Cast iron.
 - 4. Clamping Device: Required.
 - 5. Outlet Connection: Threaded.
 - 6. Tapered thread ABS plug.
 - 7. Adjustable Housing Material: Set-screws or other device.
 - 8. Frame and Cover Material and Finish: Stainless steel Z1469.
 - 9. Frame and Cover Shape: Round.
 - 10. Top Loading Classification: Heavy duty.

2.7 FLOOR DRAINS (REFER TO DRAWING FOR OUTLET SIZE(S))

- A. Floor Drains: Comply with ASME A112.21.1M.
 - 1. Application: Type FD-1.
 - 2. Products:
 - a. Smith, Jay R. Mfg. Co. 2005
 - b. Tyler Pipe, Wade Div.
 - c. Josam Co.
 - 3. Body Material: Gray iron.
 - 4. Seepage Flange: Required.
 - 5. Clamping Device: Required.
 - 6. Outlet: Bottom.
 - 7. Exposed Surfaces and Interior Lining: Not required.
 - 8. Sediment Bucket: Required.
 - 9. Top or Strainer Material: Cast iron.
 - 10. Top of Body and Strainer Finish: Cast iron.
 - 11. Top Shape: Round.
 - 12. Dimensions of Top or Strainer: 5 inch.
 - 13. Top Loading Classification: Medium Duty.
 - 14. Funnel: Not required.
 - 15. Inlet Fitting: Not required.
 - 16. Trap Material: Cast iron.
 - 17. Trap Pattern: Deep-seal P-trap.
 - 18. Trap Features: None.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- C. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.
- D. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
- E. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- F. 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. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 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.
- G. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.
- H. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- I. Install wood-blocking reinforcement for wall mounting and recessed-type plumbing specialties.
- J. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 22 Section "General Duty Valves" for general-duty ball, butterfly, check, gate, and globe valves.
- K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- L. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipefittings.

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. Connect plumbing specialties to piping specified in other Division 22 Sections.
- D. Ground equipment.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- F. Connect plumbing specialties and devices that require power according to Division 26 Sections.

3.3 CASEWORK

- A. Install supply, drainage and vent, piping to and within the casework and hoods. Provide drops to casework and hoods and including final connection to the building service rough-in connection. This includes such items as gas, water or other supplies.
- B. Plumbing equipment supports required with the casework shall be supplied and installed as part of the casework.

- C. Sinks and fixtures that are not an integral part of the countertop such as epoxy or stainless steel sinks in chemical resistant counter tops shall be set as follows:

1. Stainless steel sinks complete as part of the Work under this Section.
2. Cutouts required for sinks, pedestal, faucets, service fixtures mounted on casework or countertops shall be made as part of the casework in the shop or field for use by the Contractor.

3.4 HANDICAPPED PLUMBING FIXTURE INSTALLATION

- A. Installation of handicapped plumbing fixture must comply with Michigan Department of Labor - Barrier Free Design Rules (latest edition). Quantity and mounting heights of water closets, urinals, lavatories and drinking fountains must comply with rules in effect when project is being engineered.

3.5 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate on or near each backflow preventer.
1. Text: 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.
 2. Refer to Division 22 Section "Mechanical Identification" for nameplates and signs.

3.6 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain trap seal primer systems. Refer to Division 01 Sections "Closeout Procedures" and "Demonstration and Training".

END OF SECTION 22 4100

SECTION 23 0593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes TAB to produce design objectives for the following:
 - 1. Air Systems:
 - a. Constant air volume systems.
 - 2. Verifying that automatic control devices are functioning properly.
 - 3. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.
- C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- E. NC: Noise criteria.
- F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- G. RC: Room criteria.
- H. Report Forms: Test data sheets for recording test data in logical order.
- I. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- J. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- K. TAB: Testing, adjusting, and balancing.
- L. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- M. Test: A procedure to determine quantitative performance of systems or equipment.

- N. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

- A. Qualification Data: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- C. Sample Report Forms: Submit two sets of sample TAB report forms.
- D. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by AABC.
- B. TAB Conference: Meet with Owner's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items: Include at least the following:
 - a. Submittal distribution requirements.
 - b. The Contract Documents examination report.
 - c. TAB plan.
 - d. Work schedule and Project-site access requirements.
 - e. Coordination and cooperation of trades and subcontractors.
 - f. Coordination of documentation and communication flow.
- C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."
- D. Instrumentation Type, Quantity, and Accuracy: As described in [AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems] [NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification]."
- E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
 - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 - 1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
 - 2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- D. Examine equipment performance data including fan curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- E. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- F. Examine system and equipment test reports.
- G. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- I. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine equipment for installation and for properly operating safety interlocks and controls.
- K. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.

4. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 5. Sensors are located to sense only the intended conditions.
 6. Sequence of operation for control modes is according to the Contract Documents.
 7. Controller set points are set at indicated values.
 8. Interlocked systems are operating.
 9. Changeover from heating to cooling mode occurs according to indicated values.
- L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks. Verify the following:
1. Permanent electrical power wiring is complete.
 2. Automatic temperature-control systems are operational.
 3. Equipment and duct access doors are securely closed.
 4. Balance and fire dampers are open.
 5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 6. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems".
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- C. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- E. Verify that motor starters are equipped with properly sized thermal protection.
- F. Check dampers for proper position to achieve desired airflow path.

- G. Check for airflow blockages.
- H. Check for proper sealing of air duct system.

3.5 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Exhaust Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
 - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.6 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.7 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
 - 1. Fan curves.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of TAB firm.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Contractor's name and address.
 - 7. Report date.
 - 8. Signature of TAB firm who certifies the report.
 - 9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

10. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 11. Nomenclature sheets for each item of equipment.
 12. Data for terminal units, including manufacturer, type size, and fittings.
 13. Notes to explain why certain final data in the body of reports varies from indicated values.
 14. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- E. Fan Test Reports: For exhaust fans, include the following:
1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in **inches**, and bore.
 - h. Sheave dimensions, center-to-center, and amount of adjustments in **inches**.
 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in **inches**, and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in **inches**.
 - g. Number of belts, make, and size.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in **cfm**.
 - b. Total system static pressure in **inches wg**.
 - c. Fan rpm.
 - d. Discharge static pressure in **inches wg**.
 - e. Suction static pressure in **inches wg**.
- F. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
 - a. System and air-handling unit number.

- b. Location and zone.
- c. Traverse air temperature in **deg F**.
- d. Duct static pressure in **inches wg**.
- e. Duct size in **inches**.
- f. Duct area in **sq. ft**.
- g. Indicated airflow rate in **cfm**.
- h. Indicated velocity in **fpm**.
- i. Actual airflow rate in **cfm**.
- j. Actual average velocity in **fpm**.
- k. Barometric pressure in **psig**.

G. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Test apparatus used.
- d. Area served.
- e. Air-terminal-device make.
- f. Air-terminal-device number from system diagram.
- g. Air-terminal-device type and model number.
- h. Air-terminal-device size.
- i. Air-terminal-device effective area in **sq. ft**.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in **cfm**.
- b. Air velocity in **fpm**.
- c. Preliminary airflow rate as needed in **cfm**.
- d. Preliminary velocity as needed in **fpm**.
- e. Final airflow rate in **cfm**.
- f. Final velocity in **fpm**.
- g. Space temperature in **deg F**.

H. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.8 INSPECTIONS

A. Initial Inspection:

- 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.

2. Randomly check the following for each system:

- a. Measure airflow of at least 10 percent of air outlets.
- b. Measure water flow of at least 5 percent of terminals.
- c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
- d. Measure sound levels at two locations.
- e. Measure space pressure of at least 10 percent of locations.
- f. Verify that balancing devices are marked with final balance position.
- g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Owner's Representative.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Owner's Representative.
3. Owner's Representative shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.9 ADDITIONAL TESTS

- A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 23 0593

SECTION 23 0713 – DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes semirigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 07 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
 - 2. Section 22 0719 "Pipe Insulation" for insulation for piping systems.
 - 3. Section 23 3113 "Metal Ducts" for duct liner.

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Removable insulation sections at access panels.
 - 2. Application of field-applied jackets.
 - 3. Applications at linkages for control devices.
- C. Samples: For each type of insulation and field-applied jacket. Identify each Sample, describing product and intended use. Submit 12-inch- square sections of each sample material.
 - 1. Manufacturer's Color Charts: Show the full range of colors available for each type of field-applied finish material indicated.
- D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
- E. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

- B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate clearance requirements with duct Installer for insulation application.

1.7 SCHEDULING

- A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.
 - d. Schuller International, Inc.

2.2 INSULATION MATERIALS

- A. All insulation shall comply with ASHRAE90.1 or the latest edition of the Michigan Energy Code.
- B. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- C. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

2.4 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd.
 - 1. Tape Width: 4 inches.
- B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
 - 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
 - 2. Galvanized Steel: 0.005 inch thick.
 - 3. Aluminum: 0.007 inch thick.
 - 4. Brass: 0.010 inch thick.
 - 5. Nickel-Copper Alloy: 0.005 inch thick.
- C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.
- D. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.
 - 1. Welded Pin Holding Capacity: 100 lb for direct pull perpendicular to the attached surface.
- E. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
 - 1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface.
- F. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

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.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply multiple layers of insulation with longitudinal and end seams staggered.
- E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- F. Keep insulation materials dry during application and finishing.
- G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- H. Apply insulation with the least number of joints practical.
- I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
- K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- L. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
 - 3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
- N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.
 - 1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
 - 2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.
- O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
 - 1. Seal penetrations with vapor-retarder mastic.
 - 2. Apply insulation for exterior applications tightly joined to interior insulation ends.
 - 3. Seal insulation to roof flashing with vapor-retarder mastic.

- P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - 4. Impale insulation over anchors and attach speed washers.
 - 5. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
 - 7. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.
 - 8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - 9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch-wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
 - 10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 FIELD-APPLIED JACKET APPLICATION

- A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.
 - 1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 - 2. Embed glass cloth between two 0.062-inch-thick coats of jacket manufacturer's recommended adhesive.
 - 3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.6 FINISHES

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 09 Section "Painting."
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.7 DUCT SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.
- C. Insulate the following plenums and duct systems:
 - 1. Indoor concealed supply-, return-, and outside-air ductwork.
 - 2. Indoor exposed supply-, return-, and outside-air ductwork.
- D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
 - 1. Metal ducts with duct liner.
 - 2. Factory-insulated flexible ducts.
 - 3. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
 - 4. Flexible connectors.
 - 5. Vibration-control devices.
 - 6. Testing agency labels and stamps.
 - 7. Nameplates and data plates.
 - 8. Access panels and doors in air-distribution systems.

3.8 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

- A. Service: Round, supply-air ducts, concealed.
 - 1. Material: Mineral-fiber blanket.
 - 2. Thickness: 1".
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Foil and paper.
 - 5. Vapor Retarder Required: Yes.
- B. Service: Rectangular, supply-air ducts, concealed.
 - 1. Material: Mineral-fiber blanket.
 - 2. Thickness: 2".
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Foil and paper.
 - 5. Vapor Retarder Required: Yes.
- C. Service: Rectangular, return-air ducts, concealed.
 - 1. Material: Mineral-fiber blanket.
 - 2. Thickness: 1".
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Foil and paper.
 - 5. Vapor Retarder Required: Yes.

D. Service: Rectangular, supply-air ducts, exposed.

1. Material: Mineral-fiber blanket.
2. Thickness: 2".
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

E. Service: Rectangular, return-air ducts, exposed.

1. Material: Mineral-fiber blanket.
2. Thickness: 1-1/2".
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

F. Service: Rectangular, outside-air ducts, exposed.

1. Material: Mineral-fiber blanket.
2. Thickness: 1-1/2".
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

END OF SECTION 23 0713

SECTION 23 0900 - HVAC INSTRUMENTATION AND CONTROLS

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 control equipment for HVAC systems and components, including control components for terminal heating and cooling units.

1.3 SYSTEM DESCRIPTION

- A. New Work: Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required to complete the installation of the controls for equipment as indicated on the drawings and herein described.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 - 1. Each control device labeled with setting or adjustable range of control.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 - 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
 - 3. Written description of sequence of operation.
 - 4. Schedule of valves including leakage and flow characteristics.
 - 5. Listing of connected data points, including connected control unit and input device. Input/output point summary with recommended set points.
 - 6. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
 - 7. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
 - 8. Bill of materials to identify each control device.
 - 9. A complete set of shop drawings shall be properly identified with the Engineer's project number and title. Shop drawings shall be 11" x 17" size (minimum).

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is a certified installer of the automatic control system manufacturer for both installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: A firm experienced in manufacturing automatic temperature-control systems similar to those indicated for this Project and with a record of successful in-service performance.
- C. 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.

- D. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."
- E. Comply with ASHRAE 135 for DDC system control components.

1.6 ACCEPTANCE PROCEDURE

- A. Submittal data relevant to point index, functions, limits, sequences, interlocks, power fail-restarts, logs, software routines and associated parameters, and other pertinent information for the operating system and data base shall be forwarded from Contractor to the Owner.
- B. Specified software packages including data base will be entered into the system and debugged. A complete demonstration, prior to on-line operation of the application software shall be performed in the presence of the Owner.
- C. Submittal data relevant to panel schedules and other pertinent equipment information requiring approval prior to field loading into DDC panels, will be forwarded from the Contractor to the Owner, upon receipt of approval, the Contractor will proceed with software and data loading, set-up, calibration and checkout of the various control and monitoring systems.
- D. Wiring diagrams of all hardware and maintenance manuals shall be submitted for the equipment provided.
- E. When the systems are completed, operate equipment as directed by Architect/Engineer. Replace all faulty equipment. Make necessary adjustments before final acceptance.
- F. Provide all materials, equipment, etc., and labor required for tests.
- G. Contractor shall coordinate with other contractors for the time of final system check.
- H. Upon successful completion of system generation and on-line operation, the Owner shall be requested in writing to inspect and approve the satisfactory operation of the Temperature Control System, sub-system(s) and accessories. Upon receipt of a detailed punch list from the Owner, an installation inspection report will be prepared by the Contractor showing by system, each outstanding item on the punch list. A copy of this report will be made for the Owner.
- I. Where it is required for the Contractor to modify, alter, add or remove hardware or software programs of the installed system or related accessories for the purpose of eliminating punch list items, off-line operation and testing to implement them shall be done as required by the Contractor until such time acceptable performance of the installed system has been established.

1.7 WARRANTY

- A. Contractor guarantees that this installation is free from defects and agrees to replace or repair, free of any charge to the satisfaction of the Owner's Representative any part of this installation including all components, parts and assemblies of the System which may fail within a period of one year after final acceptance, provided that such failure is due to defects in the materials or workmanship or to failure to follow the specifications and drawings. The Contractor shall file with the Owner any and all guarantees from the equipment manufacturers and what operating conditions and performance capacities they are based on.
- B. The Contractor shall initiate the warranty period by formally transmitting to the Owner commencement notification of the period for the system and devices accepted.

1.8 OWNER'S INSTRUCTION

- A. Provide a training program encompassing equipment and systems for client's operating and maintenance personnel. Coordinate training schedule with the Owner.
- B. Training staff shall include Contractor's personnel supplemented by equipment manufacturer's engineering representative.
- C. Utilize corrected equipment and system shop drawings, manuals, demonstration apparatus and installed, functioning equipment.
- D. During system commissioning and when acceptable performance of the system hardware and software has been established, provide on-site operator and maintenance personnel instruction. Instruction shall be by acceptable competent Contractor Representatives familiar with the systems and computer software, hardware, and accessories.
- E. Provide 4 hours of "classroom" instruction to the client's personnel on the operation of DDC System equipment. Operator instruction shall include the overall operational program, equipment functions (both individually and as part of the total integrated system), commands, advisories, and appropriate operator intervention required in responding to the systems operation. Use the operating and maintenance manuals described above as texts during the instructional 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. DDC, BAS or EMCS Controls:
 - a. Michigan Environmental Controls

2.2 CONTROL WIRING

- A. Control wiring and cabling shall be per equipment manufacturer's recommendation and requirements of the temperature control systems.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Label every single control device and component including, but not limited to, space sensors, well sensors, AFS's, control panels, damper actuators, VAV box controllers, valves, outdoor air sensors, relays, pressure sensors, differential pressure transmitters, pressure switches, etc. Label must include plain English descriptor and BAS point ID that matches the ID on the OWS exactly.
- B. Verify that conditioned power supply is available to control units and operator workstation.
- C. Verify that duct-, pipe-, and equipment-mounted devices and wiring and pneumatic piping are installed before proceeding with installation.

3.2 INSTALLATION

- A. Install equipment level and plumb.
- B. Install software in control units and operator workstation. Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- C. Connect and configure equipment and software to achieve sequence of operation specified.

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Control wiring in exposed areas and within walls shall be in conduit or EMT as specified in the Electrical Requirements - Division 16.

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
 - 1. Install piping adjacent to machine to allow service and maintenance.
- B. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 VIBRATION ISOLATION

- A. Components:
 - 1. Provide vibration isolation for controllers and components, either by location or by mounting devices.

3.6 FIELD QUALITY CONTROL

- A. After the inspection has been completed, check systems for continuity.
- B. After completion of system installation, the Contractor shall test, adjust, and readjust as necessary, all control equipment in terms of design, function, systems balance, performance, and otherwise make ready for air handling systems acceptance tests.
- C. After systems acceptance and after the systems have operated in normal service for two weeks, check the adjustment on instruments and devices and correct items found to be out of order. When systems are in specified operating condition, and other pertinent specifications have been complied with, temperature control systems will be accepted for heating, ventilating and air conditioning systems. Readjustments necessary to accomplish the specified results shall be made during the warranty period upon request.
- D. Coordinate with system manufacturer's representative the time of the final system check.
- E. Provide equipment to check the calibration of instruments. Instruments not in calibration shall be recalibrated to function as required, or shall be replaced.

- F. Calibrate and adjust control devices, linkages, accessories, and components for stable and accurate operation to meet the design intent and to obtain optimum performance from the equipment controlled. Final adjustment, calibration and checking shall be performed while the respective controlled systems are in full operation. Cause every device to automatically function as intended to insure its proper operation.
- G. After calibrations, adjustments, and checking have been completed and systems are operational, demonstrate to the administrative authorities having jurisdiction and to the Architect-Engineer the complete and correct functioning of all control systems and equipment. These demonstrations shall consist of operating the controls through their normal full ranges and sequences. Simulate abnormal conditions to demonstrate proper functioning of safety devices. Readjust settings to their correct design values, and after sufficient time, observe ability of controls to establish the desired conditions, noting abnormal deviations. Make necessary repairs, replacements or adjustments on items which fail to perform satisfactorily and repeat tests to demonstrate compliance with the design intent.

END OF SECTION 23 0900

SECTION 23 3113 – METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from **minus 2- to plus 10-inch wg.**
- B. Related Sections include the following:
 - 1. Division 07 Section "Joint Sealants" for fire-resistant sealants for use around duct penetrations and fire-damper installations in fire-rated floors, partitions, and walls.
 - 2. Division 08 Section "Access Doors" for wall- and ceiling-mounted access doors for access to concealed ducts.
 - 3. Section 23 0593 "Testing, Adjusting, and Balancing" for air balancing and final adjusting of manual-volume dampers.
 - 4. Section 23 0900 "HVAC Instrumentation and Controls" for automatic volume-control dampers and operators.
 - 5. Section 23 3300 "Duct Accessories" for dampers, sound-control devices, duct-mounted access doors and panels, turning vanes, and flexible ducts.
 - 6. Section 23 3713 "Diffusers, Registers, and Grilles."

1.3 DEFINITIONS

- A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula $\text{Btu} \times \text{in./h} \times \text{sq. ft.} \times \text{deg F}$ or $\text{W/m} \times \text{K}$ at the temperature differences specified. Values are expressed as Btu or W.
 - 1. Example: Apparent Thermal Conductivity (k-Value): 0.26 or 0.037.

1.4 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

- A. Product Data: For duct liner and sealing materials.
- B. Shop Drawings: Show details of the following:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Duct layout indicating pressure classifications and sizes on plans.
 - 3. Fittings.
 - 4. Reinforcement and spacing.
 - 5. Seam and joint construction.
 - 6. Penetrations through fire-rated and other partitions.

7. Terminal unit, coil, and humidifier installations.
 8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
- C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
1. Ceiling suspension assembly members.
 2. Other systems installed in same space as ducts.
 3. Ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
 4. Coordination with ceiling-mounted items, including lighting fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.
- D. Welding Certificates: Copies of certificates indicating welding procedures and personnel comply with requirements in "Quality Assurance" Article.
- E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- F. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

1.6 QUALITY ASSURANCE

- A. Welding Standards: Qualify welding procedures and welding personnel to perform welding processes for this Project according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports; AWS D1.2, "Structural Welding Code--Aluminum," for aluminum supporting members; and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.
- C. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.
- D. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Chapter 3, "Duct System," for range hood ducts, unless otherwise indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle sealant and firestopping materials according to manufacturer's written recommendations.
- C. Deliver and store stainless-steel sheets with mill-applied adhesive protective paper maintained through fabrication and installation.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

- B. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
 - 1. Joint and Seam Tape: 2 inches wide; glass-fiber fabric reinforced.
 - 2. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.
 - 3. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
 - 4. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

2.3 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for building materials.
 - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- B. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.
 - 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
 - 2. Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
 - 1. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
 - 3. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

2.4 RECTANGULAR DUCT FABRICATION

- A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
 - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.

2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
- B. Fabricate range hood exhaust ducts with **0.0598-inch-** thick, carbon-steel sheet for concealed ducts and **0.0500-inch-** thick stainless steel for exposed ducts. Weld and flange seams and joints. Comply with NFPA 96.
- C. Fabricate dishwasher hood exhaust ducts with **0.0500-inch-** thick stainless steel. Weld and flange seams and joints.
- D. Acid-Resistant Ducts: PVC-coated galvanized steel.
- E. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:
 1. Supply Ducts: **3-inch wg.**
 2. Return Ducts: **2-inch wg**, negative pressure.
 3. Exhaust Ducts: **2-inch wg**, negative pressure.
- F. Cross Breaking or Cross Beading: Cross break or cross bead duct sides **19 inches** and larger and **0.0359 inch** thick or less, with more than **10 sq. ft.** of unbraced panel area, unless ducts are lined.

2.5 ROUND AND FLAT-OVAL DUCT FABRICATION

- A. General: Diameter as applied to flat-oval ducts in this Article is the diameter of the size of round duct that has a circumference equal to perimeter of a given size of flat-oval duct.
- B. Round Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
 1. Thermal Conductivity (k-Value): **0.26 at 75 deg F** mean temperature.
 2. Outer Shell: Base outer-shell metal thickness on actual outer-shell dimensions. Fabricate outer-shell lengths **2 inches** longer than inner shell and insulation, and in metal thickness specified for single-wall duct.
 3. Insulation: **1-inch-** thick fibrous-glass insulation, unless otherwise indicated. Terminate insulation where internally insulated duct connects to single-wall duct or uninsulated components. Terminate insulation and reduce outer duct diameter to inner liner diameter.
 - a. Ducts **3 to 8 Inches** in Diameter: **0.019 inch** with standard spiral seam construction.
 - b. Ducts **9 to 42 Inches** in Diameter: **0.019 inch** with single-rib spiral seam construction.
 - c. Ducts **44 to 60 Inches** in Diameter: **0.022 inch** with single-rib spiral seam construction.
 - d. Ducts **62 to 88 Inches** in Diameter: **0.034 inch** with standard spiral seam construction.
 4. Maintain concentricity of liner to outer shell by mechanical means. Retain insulation from dislocation by mechanical means.

2.6 ROUND AND FLAT-OVAL SUPPLY AND EXHAUST FITTING FABRICATION

- A. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal seam straight duct.
- B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.

- C. Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate bend radius of die-formed, gored, and pleated elbows one and one-half times elbow diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from **minus 2- to plus 2-inch wg**:
 - a. Ducts **3 to 26 Inches** in Diameter: **0.028 inch**.
 - b. Ducts **27 to 36 Inches** in Diameter: **0.034 inch**.
 - c. Ducts **37 to 50 Inches** in Diameter: **0.040 inch**.
 - d. Ducts **52 to 60 Inches** in Diameter: **0.052 inch**.
 - e. Ducts **62 to 84 Inches** in Diameter: **0.064 inch**.
 3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from **2- to 10-inch wg**:
 - a. Ducts **3 to 14 Inches** in Diameter: **0.028 inch**.
 - b. Ducts **15 to 26 Inches** in Diameter: **0.034 inch**.
 - c. Ducts **27 to 50 Inches** in Diameter: **0.040 inch**.
 - d. Ducts **52 to 60 Inches** in Diameter: **0.052 inch**.
 - e. Ducts **62 to 84 Inches** in Diameter: **0.064 inch**.
 4. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal seam flat-oval duct.
 5. 90-Degree, Two-Piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material-handling classes A and B; and only where space restrictions do not permit using 1.5 bend radius elbows. Fabricate with single-thickness turning vanes.
 6. Round Elbows, **8 Inches** and Smaller: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
 7. Round Elbows, **9 through 14 Inches**: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees, unless space restrictions require a mitered elbow. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
 8. Round Elbows, Larger Than **14 Inches**, and All Flat-Oval Elbows: Fabricate gored elbows, unless space restrictions require a mitered elbow.
 9. Die-Formed Elbows for Sizes through **8 Inches** and All Pressures: **0.040 inch** thick with two-piece welded construction.
 10. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
 11. Flat-Oval Elbow Metal Thickness: Same as longitudinal seam flat-oval duct specified above.
 12. Pleated Elbows for Sizes through **14 Inches** and Pressures through **10-Inch wg**: **0.022 inch**.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

- A. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.
- B. Construct and install each duct system for the specific duct pressure classification indicated.
- C. Install round and flat-oval ducts in lengths not less than **12 feet**, unless interrupted by fittings.
- D. Install ducts with fewest possible joints.
- E. Install fabricated fittings for changes in directions, changes in size and shape, and connections.

- F. Install couplings tight to duct wall surface with a minimum of projections into duct.
- G. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
- K. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- L. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches.
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 07 Section "Firestopping."

3.2 SEAM AND JOINT SEALING

- A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Pressure Classification Less Than **2-Inch wg**: Transverse joints.
- C. Seal externally insulated ducts before insulation installation.

3.3 HANGING AND SUPPORTING

- A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Support horizontal ducts within **24 inches** of each elbow and within **48 inches** of each branch intersection.
- C. Support vertical ducts at a maximum interval of **16 feet** and at each floor.
- D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

3.4 CONNECTIONS

- A. Connect equipment with flexible connectors according to Division 23 Section "Duct Accessories."
- B. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

3.5 FIELD QUALITY CONTROL

- A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.
- B. Conduct tests, in presence of Architect, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
- C. Determine leakage from entire system or section of system by relating leakage to surface area of test section.
- D. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round and flat-oval ducts, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to **2-inch wg** (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from **2- to 10-inch wg**.
- E. Remake leaking joints and retest until leakage is less than maximum allowable.
- F. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

3.6 ADJUSTING

- A. Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.
- B. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for detailed procedures.

3.7 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

END OF SECTION 23 3113

SECTION 23 3300 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Backdraft dampers.
 - 2. Volume dampers.
 - 3. Motorized control dampers.
 - 4. Turning vanes.
 - 5. Duct-mounting access doors.
 - 6. Flexible connectors.
 - 7. Flexible ducts.
 - 8. Duct accessory hardware.
 - 9. Fire dampers.
- B. Related Sections include the following:
 - 1. Division 28 Section "Fire Alarm" for duct-mounting fire and smoke detectors.
 - 2. Division 23 Section "HVAC Instrumentation and Controls" for electric and pneumatic damper actuators.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Backdraft dampers.
 - 2. Volume dampers.
 - 3. Motorized control dampers.
 - 4. Fire dampers.
 - 5. Turning vanes.
 - 6. Duct-mounting access doors.
 - 7. Flexible connectors.
 - 8. Flexible ducts.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Special fittings.
 - 2. Manual-volume damper installations.
 - 3. Motorized-control damper installations.
 - 4. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having **G90** coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Stainless Steel: ASTM A 480/A 480M.
- D. Aluminum Sheets: **ASTM B 209**, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: **ASTM B 221**, alloy 6063, temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, **1/4-inch** minimum diameter for lengths **36 inches** or less; **3/8-inch** minimum diameter for lengths longer than **36 inches**.

2.3 FIRE DAMPERS

- A. Manufacturers:
 - 1. Greenheck.
 - 2. Nailor Industries Inc.
 - 3. Penn Ventilation Company, Inc.
 - 4. Ruskin Company.
- B. Fire dampers shall be labeled according to UL 555.
- C. Fire Rating: 1-1/2 and 3 hours.

- D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.052 or 0.138 inch thick as indicated and of length to suit application.
 - 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

2.4 BACKDRAFT DAMPERS

- A. Manufacturers:
 - 1. Air Balance, Inc.
 - 2. Greenheck.
 - 3. Penn Ventilation Company, Inc.
 - 4. Ruskin Company.
- B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.
- C. Frame: 0.063-inch thick extruded aluminum with welded corners and mounting flange.
- D. Blades: 0.025-inch thick, roll-formed aluminum.
- E. Blade Seals: Vinyl.
- F. Tie Bars and Brackets: Aluminum.
- G. Return Spring: Adjustable tension.

2.5 VOLUME DAMPERS

- A. Manufacturers:
 - 1. Air Balance, Inc.
 - 2. McGill AirFlow Corporation.
 - 3. Nailor Industries Inc.
 - 4. Penn Ventilation Company, Inc.
 - 5. Ruskin Company.
 - 6. Greenheck.

- B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
 - 1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
- C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
 - 1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
 - 2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
 - 3. Aluminum Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
 - 4. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
 - 5. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.

2.6 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
- B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, single-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.
 - 1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Duro Dyne Corp.
 - c. METALAIRE, Inc.
 - d. Ward Industries, Inc.
 - e. Semco, Inc.
- C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.7 DUCT-MOUNTING ACCESS DOORS

- A. General Description: Fabricate doors airtight and suitable for duct pressure class.
- B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.
 - 1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Greenheck.
 - c. McGill AirFlow Corporation.
 - d. Nailor Industries Inc.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3. Provide number of hinges and locks as follows:

- a. Less Than **12 Inches** Square: Secure with two sash locks.
- b. Up to **18 Inches** Square: Two hinges and two sash locks.
- c. Up to **24 by 48 Inches**: Three hinges and two compression latches with outside and inside handles.
- d. Sizes **24 by 48 Inches** and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and **1-inch** thickness. Include cam latches.

1. Manufacturers:

- a. Ductmate Industries, Inc.
- b. Flexmaster U.S.A., Inc.
- c. Semco, Inc.

2. Frame: Galvanized sheet steel, with spin-in notched frame.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

E. Insulation: **1-inch-** thick, fibrous-glass or polystyrene-foam board.

2.8 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.
5. Semco, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: **26 oz./sq. yd.**
2. Tensile Strength: **480 lbf/inch** in the warp and **360 lbf/inch** in the filling.
3. Service Temperature: **Minus 40 to plus 200 deg F.**

D. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: **14 oz./sq. yd.**
2. Tensile Strength: **450 lbf/inch** in the warp and **340 lbf/inch** in the filling.
3. Service Temperature: **Minus 67 to plus 500 deg F.**

2.9 FLEXIBLE DUCTS

A. Manufacturers:

1. Flexmaster U.S.A., Inc.
2. Hart & Cooley, Inc.
3. McGill AirFlow Corporation.

- B. Insulated-Duct Connectors: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.
- C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18 inches to suit duct size.

2.10 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards-Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.
- E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.
- F. Provide test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install the following sizes for duct-mounting, rectangular access doors:
 - 1. Two-Hand Access: 12 by 6 inches.
- H. Label access doors according to Division 22 Section "Mechanical Identification."
- I. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
- J. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- K. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

- L. Connect diffusers or light troffer boots to low pressure ducts directly or with maximum **60-inch** lengths of flexible duct clamped or strapped in place.
- M. Connect flexible ducts to metal ducts with **[adhesive] [liquid adhesive plus tape] [draw bands] [adhesive plus sheet metal screws]**.
- N. Install duct test holes where indicated and required for testing and balancing purposes.

3.2 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire and smoke dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION 23 3300

SECTION 23 3423 – HVAC POWER VENTILATORS

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. Centrifugal roof ventilators.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base air ratings on actual site elevations.
- B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material gages and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
 - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
- C. Coordination Drawings: Show roof penetration requirements and reflected ceiling plans drawn to scale and coordinating roof penetrations and units mounted above ceiling. Show the following:
 - 1. Roof framing and support members relative to duct penetrations.
 - 2. Ceiling suspension assembly members.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Maintenance Data: For power ventilators to include in maintenance manuals specified in Division 01.

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. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Centrifugal Roof Ventilators:
 - a. Cook, Loren Company.
 - b. Greenheck Fan Corp.

2.2 CENTRIFUGAL ROOF VENTILATORS

- A. Description: Direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
- C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- D. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent.

2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.

E. Roof Curbs: By others. Coordinate size and location with Owner's roofing contractor.

2.3 MOTORS

- A. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.
- B. Enclosure Type: Guarded dripproof.

2.4 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Support units using spring isolators having a static deflection of 1 inch.
 1. Secure vibration controls to concrete bases using anchor bolts cast in concrete base.
- C. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.
- D. Support suspended units from structure using threaded steel rods and spring hangers.
- E. Install units with clearances for service and maintenance.
- F. Label units according to requirements specified in Division 22 Section "Mechanical Identification."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment.
- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Equipment Startup Checks:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Verify lubrication for bearings and other moving parts.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
7. Disable automatic temperature-control operators.

B. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.
2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Shut unit down and reconnect automatic temperature-control operators.

F. Refer to Section 23 0593 "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

G. Replace fan and motor pulleys as required to achieve design airflow.

H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

3.5 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 - 2. Review data in maintenance manuals. Refer to Division 01 Section "Closeout Procedures."
 - 3. Review data in maintenance manuals. Refer to Division 01 Section "Operation and Maintenance Data."
 - 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 23 3423

SECTION 23 3713 – DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
 - 1. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
 - 2. Section 23 3300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
 - 3. Section 23 0593 "Testing, Adjusting, and Balancing" for balancing diffusers, registers, and grilles.

1.3 DEFINITIONS

- A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.
- B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.
- C. Register: A combination grille and damper assembly over an air opening.

1.4 SUBMITTALS

- A. Product Data: For each model indicated, include the following:
 - 1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
 - 2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
 - 3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
 - 4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.
- B. Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.

1.5 QUALITY ASSURANCE

- A. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 01 Section "Substitutions."
- B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Diffusers, registers, and grilles are scheduled on Drawings.

2.2 SOURCE QUALITY CONTROL

- A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the grid. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

- A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

3.5 DIFFUSERS, REGISTERS AND GRILLES

- A. Manufacturers:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Price.
 - b. Titus.

END OF SECTION 23 3713

SECTION 23 8316 - RADIANT HEATING PANELS

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. Alternates: Refer to 01 2300 "Alternates" for the list of alternates and requirements.
- C. Related Sections:
 - 1. Section 22 0500 Common Work Results for Mechanical
 - 2. Section 22 0523 Valves
 - 3. Section 22 0719 Pipe Insulation
 - 4. Section 22 1113 Piping Materials and Methods

1.2 SUMMARY

- A. This Section includes hydronic radiant heating panels for space-heating applications.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, specialties, and accessories for each product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Samples for Initial Selection: For each exposed product and for each color and finish required.
- E. Maintenance Data: For radiant heating panels to include in maintenance manuals specified in Division 01.
- F. Warranties: Special warranties specified in this Section.

1.4 COORDINATION

- A. Coordinate layout and installation of radiant heating panels and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.5 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hydronic Radiant Heating Panels:

- a. Aero-tech
- b. Air-Tex
- c. Sterling/TWA
- d. Price
- e. Airtherm
- f. Rittling

2.2 HYDRONIC PANELS

- A. Description: Linear extruded-aluminum panel with copper water coil, mechanically attached to backside, suitable for lay-in installation flush with T-bar ceiling grid.

- 1. Copper Coil: **NPS 1/2**.
- 2. Nominal Size: Width, length as indicated.
- 3. Minimum Heating Output: 180 deg F at **170 deg F** average water temperature with **70 deg F** room temperature.
- 4. Color: Manufacturer's standard off-white.
- 5. Optional Sections: Refer to Schedule on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive radiant heating panels for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for hot-water piping connections to verify actual locations before radiant heating panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install radiant heating panels level and plumb.
- B. Hang or support cabinet unit heaters according to Section 22 1113 "Piping Materials and Methods".

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Unless otherwise indicated, install shutoff valve and union or flange at each connection.
- C. Install piping to allow service and maintenance.

3.4 CLEANING

- A. After installing panels, inspect unit cabinet for damage to finish. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

END OF SECTION 23 8316

DIVISION 26 - ELECTRICAL

SECTION 26 0500 – 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 work of this Section.
- B. This Section shall apply to all Division 26 Sections.

1.2 SUMMARY

- A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01 Sections.
 - 1. Codes and standards
 - 2. Quality assurance
 - 3. Examination of drawings and premises
 - 4. Substitutions
 - 5. Permits, fees and inspections
 - 6. Changes involving Electrical Work
 - 7. Submittals
 - 8. Project record documents
 - 9. Operation and maintenance manuals and equipment
 - 10. Delivery, storage and handling
 - 11. Warranty
- B. This Section includes the following:
 - 1. Description of electrical systems
 - 2. Scope of work specified in Division 26
 - 3. Related work specified in other Divisions
 - 4. Systems provided by the Owner
 - 5. Alternates that apply to the electrical work
- C. This Section includes basic requirements for materials and installations for electrical work, including but not limited to:
 - 1. Access doors
 - 2. Sealing of openings
 - 3. Sleeves
 - 4. Expansion fittings
 - 5. Electrical demolition work
 - 6. Cutting and patching
 - 7. Chases and recesses
 - 8. Coordination with other trades
 - 9. Assembly and connection of equipment
 - 10. Field quality control

1.3 CODES AND STANDARDS

- A. The electrical characteristics, physical properties, design, performance characteristics, methods of construction, all material and the installation techniques, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:
1. ADA – Americans with Disabilities Act
 2. AEIC – Association of Edison Illuminating Companies
 3. ANSI - American National Standards Institute
 4. ASTM - American Society for Testing Materials
 5. BICSI - Building Industry Consulting Service International
 6. FCC - Federal Communication Commission
 7. ICEA - Insulated Cable Engineers Association
 8. IEC – International Electrotechnical Commission
 9. IEEE - Institute of Electrical and Electronics Engineers
 10. MBC – Michigan Building Code
 11. MIOSHA – Michigan Occupational Safety Hazard Association
 12. NEC - National Electrical Code
 13. NETA – International Electrical Testing Association
 14. NEMA - National Electrical Manufacturer's Association
 15. NFPA - National Fire Protection Association
 16. OSHA – Occupational Safety and Health Act
 17. UL - Underwriters Laboratories, Inc.

1.4 QUALITY ASSURANCE

- A. Furnish all labor, materials, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the electrical systems as specified in the Division 26 Sections and as indicated on Drawings.
1. The Electrical Drawings indicate the general design and extent of the electrical system. Comply with the Drawings as closely as actual construction of the building and the work of other Trades permit.
- B. Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.
1. All equipment of the same or similar systems shall be by the same manufacturer.
- C. Regulatory Requirements:
1. Ordinances, Codes and Standards: Perform all work in accordance with applicable Federal, State and local ordinances and regulations. Perform all work to comply with Codes and Standards identified in these specifications.
 - a. Notify the Architect/Engineer before submitting his proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations. After entering into Contract, make all changes required to conform to above ordinances, rules and regulations without additional expense to the Owner.
 - b. Barrier-Free Regulations: All materials and installations shall comply with the requirements of the State of Michigan Handicapped Barrier-Free Regulations and with the Americans with Disabilities Act (ADA).

D. Field Measurements:

1. Drawings are not intended to be scaled for roughing-in or to serve as shop drawings. Take all field measurements required for fitting the installation to the building.

E. Sequencing and Scheduling: Sequence and schedule work so as to avoid interference with the work of other Trades. Be responsible for removing and relocating any work which in the opinion of the Owner's Representatives causes interference.

1.5 EXAMINATION OF DRAWINGS AND PREMISES

A. Before submitting Bids, examine the site, architectural, mechanical and other trades' drawings and specifications.

1. Notify Architect/Engineer should any discrepancies occur between them and the electrical work.
2. No additional charges will be allowed because of failure to make this examination, or to include all materials and labor required for the Electrical Work specified in other trade's documents or required due to existing conditions.
3. Before submitting Bids, examine the premises to determine existing conditions for performing the Work. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.
4. The Architectural Drawings take precedence in all matters pertaining to the building structure, Mechanical drawings in all matters pertaining to Mechanical trades and Electrical drawings in all matters pertaining to Electrical trades installation. However, where there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect/Engineer who shall determine the course of action to be taken.

1.6 SUBSTITUTIONS

A. Base Bid shall be in accordance with materials or products specified. Any exceptions to this shall be approved in writing by the Architect/Engineer ten (10) days or more prior to bidding.

1. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the Bid, but will not affect the awarding of the Contract.

1.7 PERMITS, FEES AND INSPECTIONS

A. Obtain all permits, licenses, inspections and test required. Upon completion of the Work, obtain and send certificates of inspections and approvals to the Architect/Engineer.

1. Pay all fees and expenses for permits, licenses, tests and inspections.
2. A copy of the final approved Certificate of Electrical Inspection shall be provided as a requirement prior to final payment.

1.8 CHANGES INVOLVING ELECTRICAL WORK

A. The design of the electrical systems is based on the mechanical and building equipment specified and scheduled on the Drawings.

1. Where equipment changes are made that involve additional electrical work (increased motor horsepower or increased unit full load amperes, requirements for a disconnect switch scheduled to be part of the equipment, requirements for a starter scheduled to be part of the equipment, additional wiring of equipment, etc.) the Mechanical or respective trades involved shall compensate the electrical trades for the cost of the additional work required.

1.9 SUBMITTALS

- A. The following is in addition to the requirements for submittals in Division 01.
- B. Material List: Submit a complete list of all materials, equipment, and their manufacturers, for approval by the Architect/Engineer within 15 days after award of contract and prior to submittal of shop drawings.
- C. Provide equipment submittals in the form of letters of intent, product data catalog sheets or shop drawings as hereinafter specified for all materials provided on the project.
- D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
 - 1. Provide a space approximately 4" x 5" on the label or beside the title block on shop drawings to record the Contractor's review and approval markings and the action taken.
 - 2. Include the following information on the label for processing and recording action taken.
 - a. Project Name
 - b. Date
 - c. Name and address of Architect/Engineer
 - d. Name and address of Contractor
 - e. Name and address of Subcontractor
 - f. Name and address of Supplier
 - g. Name of Manufacturer
 - h. Number and title of appropriate Specification Section
 - i. Drawing number, identification mark, fixture type, panelboard number, specification section number, and detail references, or as noted on the electrical drawings.
- E. Equipment submittals shall be reviewed by the Electrical Contractor for completeness and accuracy and prior to submitting to the Architect/Engineer for review. Submittals shall be dated and signed by the Electrical Contractor.
- F. Partial submittals for equipment shall not be permitted. Where partial submittals are transmitted to the Architect/Engineer, they will be returned "Rejected".
- G. Where the equipment submittals consist of manufacturer's standard detail drawing or schedules and contain data for a variety of similar equipment, indicate the data pertinent to the equipment furnished for this project only. Standard detail drawings and schedules not clearly indicating which data is associated with this Project shall be returned "Rejected".
- H. Where accessories and/or options are specified and do not appear as part of manufacturer's standard detail drawings, state each accessory that is to be provided with the equipment on the standard detail drawings.
- I. Letter of Intent shall state that the product is exactly as specified with no exceptions, and that the product is being manufactured by one of the specified manufacturers. The Letter of Intent shall include the specification section number, the product description, the name of the selected manufacturer and the catalog number of the product. The aforementioned information shall be typed on the Electrical Contractor's letterhead and submitted with one (1) product data sheet for each product itemized in the Letter of Intent for record.
- J. Lighting fixture submittals shall be submitted as one (1) package including all fixtures intended to be used for this Project. Submit the following individual shop drawings for each fixture type:
 - 1. Lighting fixture
 - 2. LED's
 - 3. LED drivers

- K. No apparatus or equipment shall be shipped from stock or fabricated until equipment submittals for them have been reviewed and approved by the Architect/Engineer. By the review of shop drawings, the Architect/Engineer does not assume responsibility for actual dimensions or for the fit of completed work in position, nor does such review relieve Electrical Trades of full responsibility for the proper and correct execution of the work required.
- L. Submittals shall be provided on all major electrical systems and/or equipment, including the following:

REMARKS LEGEND

Provide the following as indicated:

- | | |
|---------------------------------------|--|
| 1. Factory Test Report | 8. Points List |
| 2. Field Testing Report | 9. Sequence of Operation |
| 3. Record Drawings | 10. Certificate of Inspection |
| 4. Mock-Up | 11. Installer Certificate & Master Label |
| 5. Material & Equip. List/Certificate | 12. Fire Marshal Approval |
| 6. Operation & Maintenance Manuals | 13. Tools/Spare Parts |
| 7. Construction Schedule | |

Section Number	Section Title	Shop Dwg.	Product Data	Letter of Intent	Samples	Warranty	Remarks
26 0500	Common Work Results for Electrical					X	6, 7, 10
	Materials List			X			5
	Electrical Systems Description						
26 0519	Low Voltage Electrical Power Conductors and Cables (0-600V)						
	Cable		X				1
	Splicing Connectors		X				
	Termination Lugs		X				
26 0526	Grounding and Bonding for Electrical Systems						
	Grounding Cable		X				
	Grounding Connections/fittings		X				
26 0529	Supporting Devices			X			
26 0533	Raceways and Boxes for Electrical Systems						
	EMT Conduit and Fittings			X			
	RGS Conduit and Fittings			X			
	Flexible Steel Conduit and Fittings			X			
	Liquid-Tite Flexible Steel Conduit and Fittings			X			
	Outlet Boxes			X			
	Pull Boxes			X			
26 0553	Identification for Electrical Systems						
	Electrical Identification Product		X		X		
	Schedule of Nomenclature			X			
26 0570	Electrical Testing						
	Tests on 600 Volt Cables						2
	Tests on Control Cables						2
	Tests on Low Voltage Panelboards						2
	Tests on Grounding						2

Section Number	Section Title	Shop Dwgs.	Product Data	Letter of Intent	Samples	Warranty	Remarks
26 0923	Lighting Control Devices						
	Wall Box Dimmers		X				2, 9
	Wall Switch Occupancy Sensor		X				2, 9
	Occupancy Sensors		X				2, 9
26 2413	Panelboards		X				1, 2, 6
26 2726	Wiring Devices						
	Wall Switches		X				2
	Receptacles		X				2
	Device Plates		X				
26 2913	Enclosed Controllers		X				1, 2, 6
26 5119	Interior Lighting						1
	Fixtures	X	X				2
	LED	X	X				2
	LED Drivers	X	X				2
28 3111	Fire Alarm System – Addressable	X	X				2,3,6,10,12

1.10 PROJECT RECORD DOCUMENTS

- A. Project Record Documents: Revise bid documents as required during construction to indicate the as-built condition.
- At the completion of the Project, resubmit to the Owner's Representative the revised set of "redlined" blueprints, (or electronic files with all changes from the bid documents bubbled) and one set of prints indicating "as-built" conditions for Owner's record. The Drawings shall contain all title block information as originally issued by the Architect/Engineer with the addition of the electrical contractor's company name, address, telephone number, company's project number, date of issuance by the electrical contractor, and issued for "Final Issue" conditions in title.
 - Furnish and deliver to the Owner's Representative a manual of all shop drawings and product data upon substantial completion. The manual shall consist of a standard hard cardboard, vinyl covered, 3-ring binder, letterhead size, 8-1/2" x 11". Shop drawings shall be folded and punched. All items and pages shall be numbered with typewritten index inserted at front of manual.
 - Submit final project record documents as described in Division 01.

1.11 OPERATION AND MAINTENANCE MANUALS AND EQUIPMENT

- A. Operation and Maintenance Manuals: The manuals shall contain operating instructions, service instructions, parts lists, etc., which are shipped with electrical equipment. On completion of the work, transmit these items to the Architect/Engineer, for the Owner's use. If this information is not shipped with the equipment, obtain from the manufacturer.
- B. Maintenance Materials: Retain all portable and detachable portions of the installation such as keys, tools, manuals, etc., until the completion of the work and then transmit them to the Owner and obtain itemized receipt. This receipt shall be attached to the "Final Application" for payment.
- C. Furnish three (3) sets of bound operation and maintenance manuals to the Architect/Engineer. Each set shall include:
- One (1) copy of all shop drawings
 - One (1) copy of operation and maintenance instructions and manuals
 - One (1) copy of all electrical testing
 - One (1) copy of as-built drawings

1.12 DELIVERY, STORAGE AND HANDLING

- A. Storage and Protection: Provide adequate storage space for all electrical equipment, conduit and materials delivered to the job site under a weather protected enclosure. Location of the space will be designated by the Owner's Field Representative. Equipment set in place in unprotected areas must be provided with temporary protection.
 - 1. Be responsible for the care and protection of electrical equipment until it has been fully tested and accepted.
 - 2. Protect materials with permanent factory finish from damage by covering.
 - 3. Protect conduit openings with temporary plugs or caps.

1.13 WARRANTY

- A. Warranty: Provide a one year parts and labor warranty for all equipment and installation. Comply with requirements of the General Conditions.

1.14 DESCRIPTION OF ELECTRICAL SYSTEMS

- 1. Power Systems: 208/120 volts, 3 phase, 4 wire, 60 hertz, neutral solidly grounded at the source.
- 2. Lighting Systems: 480/277 volts, 3 phase, 4 wire, 60 hertz, solidly grounded neutral.
- 3. Small Power System: 208/120 volts, 3 phase, 4 wire, 60 hertz, solidly grounded neutral.
- 4. Emergency Lighting Systems: 90 minute battery backup.

1.15 SCOPE OF WORK SPECIFIED IN DIVISION 26 SECTIONS

- A. Furnish all labor, materials, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the electrical systems as specified in the Division 26 Sections.
- B. Provide control wiring greater than 100 volts for control devices and control wiring, and all power wiring, required for equipment specified hereinafter.
- C. The principal items of electrical work to be furnished and installed shall include but not necessarily be limited to the following items:
 - 1. Revisions and additions to building lighting system including fixtures, ballasts, drivers, lamps, controls, etc.
 - 2. A battery-operated emergency lighting fixtures for egress and exit lighting.
 - 3. Wiring devices including switches, receptacles, plates, etc.
 - 4. Connections to mechanical equipment including starters, disconnects and branch circuit wiring.
 - 5. Branch circuit wiring to all building wiring devices, including switches, receptacles, lighting fixtures and equipment.
 - 6. Modifications to the fire alarm system.
 - 7. Testing of new power cables and new electrical equipment.
 - 8. All items incidental to and/or required to complete the installation.

1.16 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Furnishing and wiring of all new low voltage thermostats – Division 23 sections.
- B. Furnishing and installing low voltage instrumentation and control wiring – Divisions 21, 22 and 23, except where otherwise indicated.
- C. Furnishing and installing field prime and finish painting – Division 09, except as specified in Division 26.

1.17 ALTERNATES

- A. 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.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

- A. Furnish access doors as required to make accessible all controls, motors, electrical boxes and other equipment installed by Electrical trades or as required by Code.
 - 1. Architectural trades will install the access doors provided under this Section.
 - 2. Access door size shall be minimum 12" x 12" in walls, 24" x 24" in ceilings.
 - 3. Plaster or acoustical tile inserts shall be by Architectural trades.
 - 4. Equip access doors with screwdriver operated cam lock.
 - a. Recessed panel access doors shall be designed to receive plaster or acoustical tile inserts. Furnish a plastic grommet and sleeve at the lock location.
 - 5. Access doors in fire rated walls or ceilings shall be 1-1/2 hour rated, "B" label, 250 degF maximum temperature rise in 30 minutes, self-closing and self-latching and shall carry Underwriters Laboratories, Inc. (UL) or Warnock-Hersey Label.
- B. In non-fire rated gypsum board, veneer plaster, masonry or ceramic tile walls, furnish "Type M, 3202 Series" access doors as manufactured by Milcor Ltd. Partnership or approved equal.
- C. In non-fire rated gypsum board or veneer plaster walls and ceilings, furnish "Type DW, 3203 Series" by Milcor Ltd. Partnership or approved equal.
- D. In fire-rated gypsum board, veneer plaster, masonry or ceramic tile walls, furnish "3208 Series" by Milcor Ltd. Partnership or approved equal.
- E. In non-fire rated gypsum board, veneer plaster or plaster ceilings, furnish "Type M, 3202 Series" by Milcor Ltd. Partnership or approved equal.
- F. In non-fire rated plaster walls or ceilings, furnish "Type K, 3200 Series" by Milcor Ltd. Partnership or approved equal.
- G. In non-fire rated plaster or acoustical tile ceilings, furnish "Type AP, 3206 Series" and "Type AT 3205 Series" by Milcor Ltd. Partnership or approved equal.

2.2 SEALING OF OPENINGS

- A. Seal openings around electrical materials (Conduit, raceways, cable trays, panels, etc.) where floors, fire rated walls and smoke barriers are penetrated. (Fiberglass is not acceptable.) Fire and/or smoke barriers shall be UL Listed fire and smoke stop fittings and shall have fire rating equal to or greater than the penetrated barrier. Refer to Section 07 8413 "Firestop Systems".

2.3 SLEEVES

- A. Provide conduit sleeves where conduits pass through concrete floors, walls, beams and ceilings.

- B. Sleeves shall be galvanized rigid steel conduit. Do not use aluminum conduit. Where specific sizes are not indicated on the Drawings, sleeves shall be sized to provide one-half (1/2) inch clearance around the outside surface of the item for which they were installed. They shall be cut flush with wall surfaces, and shall extend one inch, or as directed through floor. Sleeves shall be packed with approved non-combustible packing material and sealed with sealant to prevent passage of air, liquid or fumes from one area to another. The filler and sealant materials used shall be rated at least equal in fire resistance to the construction material being penetrated. Floor sleeves shall be sealed between floor and sleeve with concrete grout.

2.4 EXPANSION FITTINGS

- A. Provide expansion fittings in all conduits, cable trays, and bus duct runs that cross building expansion joints, both in concrete slabs and where exposed.

PART 3 - EXECUTION

3.1 TEMPORARY SERVICES

- A. Provide temporary lighting and power in areas of work as required.

3.2 CUTTING AND PATCHING

- A. Refer to Division 01 for requirements for cutting, patching and refinishing work necessary for the installation of Electrical Work.
- B. Direct miscellaneous cutting and patching of the existing building construction for the installation of the Electrical Work.
- C. The cutting of holes through the existing building construction shall only be done by the use of abrasive saws and rotary coring machines. The use of hammer and drill points will not be permitted. The openings shall not be cut larger than necessary for the installation of the electrical work. Openings shall then be grouted in. Where existing piping, etc. is removed, the unused openings shall be grouted in.
- D. The drilling or punching of structural members, such as holes through beams or columns, shall not be done without the specific permission of the Architect/Engineer.
- E. Cutting of holes through floors and walls shall be done only at such locations as may be directed by the Architect/Engineer.
- F. Cooperate with the other Contractors so that all cutting and repairing in any given area will be done simultaneously.
- G. Electrical work which may interfere with changes in piping, ducts or other mechanical equipment, as well as conduits and outlets that may be uncovered by the cutting of new openings in present building shall be removed at the direction of the Architect/Engineer.

3.3 CHASES AND RECESSES

- A. Provide sizes and locations of chases and recesses affecting the electrical work for provision by general trades.

3.4 EQUIPMENT FOUNDATIONS AND SUPPORTS

- A. Furnish foundations and supports for electrical equipment and materials as required by codes, as listed hereinafter and shown or noted on the Drawings.

- B. Provide necessary inserts, rod, structural steel frames, brackets, platforms, etc., for equipment suspended from ceilings or walls, such as conduits, transformers, panels, etc.
- C. Inserts for equipment support shall be lead shield anchors for small work and expansion shields for large work. Wooden plugs will not be allowed. Do not use metal roof decking and cellular floors for supporting equipment.
- D. Provide and install concrete bases 4" above finished floor, with leveling channels, where noted, for floor-mounted equipment such as automatic transfer switches, switchboards, distribution panels, etc.
- E. Enclosures for panelboards, motor starters, disconnect switches and motor controls shall be mounted on 1/2" spacers when mounted in a room below grade on exterior walls or 1/4" spacers when mounted in a room at or above grade on an exterior wall.

3.5 COORDINATION WITH OTHER TRADES

- A. Install Work so as to avoid interferences with the Work of other trades. Be responsible for removing and relocating any work which, in the opinion of the Owner's Representative, causes interferences.
- B. Should construction conditions prevent the installation of switches, conduit, outlet boxes, junction boxes, conductors, lighting fixtures and/or other related equipment at locations shown on the drawings, minor deviations may be permitted and shall be as directed by the Architect/Engineer, and shall be made without additional cost to Owner.
- C. The Electrical Trades will be responsible for all damage to other Work caused by their Work or through the neglect of their workers.
 - 1. All patching and repairing of any such damaged Work shall be performed by the trades which installed the Work, but the cost shall be paid by the Electrical Trades.

3.6 ASSEMBLY AND CONNECTION OF EQUIPMENT

- A. Assembly of Equipment:
 - 1. The Contract Drawings and Specifications indicate items to be purchased and installed which are noted by a manufacturer's name, catalog number and/or brief description.
 - 2. The catalog number may not designate all the accessory parts and appurtenances required for the particular use or function.
 - 3. Arrange with the manufacturer for the purchase of all items required for the complete installation and efficient operation.
- B. Equipment Connections:
 - 1. Connections to equipment, motors, lighting fixtures, etc., shall be made in accordance with the shop drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished.
 - 2. Any and all additional connections not shown on the Drawings but called for by the equipment manufacturer's shop drawings or required for the successful operation of the particular equipment furnished shall be installed as part of this Contract at no additional charge to the Owner.

3.7 FIELD QUALITY CONTROL

- A. Testing Ducts and Conduits: Ducts and conduits which are installed underground or concealed in concrete floor slab, foundations, etc., shall be cleared of foreign material and obstructions after installation and before conductor or pullwires are draw-in, by wire brushing, swabbing and employing an iron or hardwood mandrel which is 1/4" smaller in diameter than the internal diameter of the duct or conduit. Pulling wires shall be left in empty conduits.
- B. Tests and Inspection:
 - 1. When the systems are completed, operate equipment as directed by Architect/Engineer. Replace all faulty equipment. Make necessary adjustments before final acceptance.
 - 2. Tests shall include but not be limited to panels, lighting fixtures, receptacles, fire alarm system, generator, transfer switch, emergency lighting, branch circuits, etc.
 - 3. Perform all tests required by State, City, County and/or other agencies having jurisdiction.
 - 4. Provide all materials, equipment, etc., and labor required for tests.
 - 5. Perform cable and equipment testing as specified.
- C. Cleaning:
 - 1. Keep premises free from accumulation of waste materials and rubbish. At completion of work remove all rubbish from and about the building and leave the electrical systems clean and ready for use.
 - 2. Final clean-up shall include washing of fixture lenses, switchboards, substations, transformers, motor controls, distribution panels, lighting panels, etc., to remove shipping and/or construction dust and debris. Fixture reflectors and/or lenses with water marks or cleaning streaks will not be accepted.
- D. Painting:
 - 1. In general, no painting is required by Electrical Trades other than touch-up of factory-finished electrical equipment.
 - 2. All factory finished electrical equipment shall be cleaned at completion of the job. Equipment showing rust or mars shall be thoroughly cleaned and sanded, prime coated and touched up with enamel of color to match original finish.

END OF SECTION 26 0500

SECTION 26 0519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (0-600V)

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 work of this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Conductors and cabling for buildings and structures electrical systems under 600 volts.
 - 2. Wire and cable systems as required, and all material and equipment, including wire, cable, connectors, lugs, fittings, and identification, as indicated or specified.
- B. Related Sections including the following:
 - 1. Cable tests as specified in Section 26 0570.

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.
 - 1. Conductors - Each type and size of wire and cable. Identify material, construction data, insulation thickness, and jacket thickness.
 - 2. Connectors
 - 3. Lugs
 - 4. Labels
 - 5. Insulating tape
 - 6. Submit color coding schemes for branch circuit wiring.
 - 7. Submit cable identifications.
- B. Samples: Submit samples on request of the Architect-Engineer.
- C. Submit test data for wire and cable upon request of the Architect-Engineer. Do not install wire and cable for which test data has been requested until test data is approved.

1.4 QUALITY ASSURANCE

- A. Wire, Cable and Components: Listed by Underwriters' Laboratories as meeting National Electrical Code and NFPA 70 requirements and be so labeled.
- B. Furnish wire and cable on which standard factory tests established by AEIC, ANSI, ASTM, ICEA and NEMA have been performed.
- C. Furnish cable tests as specified in 260570.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver all wire and cable to the site on reels or in coils, plainly marked for complete identification, including the wire or cable size, the number of conductors, type of wire or cable, length, weight, thickness and character of the insulation and the name of the manufacturer.

PART 2 - PRODUCTS

2.1 WIRE AND CABLE

- A. General Requirements: Furnish wire and cable per standard specifications established for such material and construction by ASTM, ANSI, IPCEA and NEMA, where applicable. All conductors shall be copper unless otherwise specified. Minimum size of conductors shall be No. 12 AWG, except 120 volt control conductors which may be No. 14 AWG and 90 volt and less shall be as specified. Furnish conductor sizes as indicated. Conductors shall be stranded for sizes No. 14 AWG and larger. Conductors smaller than #14 AWG shall be as specified in the sections requiring use of such conductors.

1. Manufacturer: Provide products of one of the following:

- a. Cerro Wire
- b. Encore
- c. General Cable Corporation
- d. Prysmian
- e. Republic Wire
- f. Southwire
- g. United Copper Industries

- B. Wire for Final Connection to Remote Ballasts: Stranded copper, NEC Type SF-2 rated 200 degC, 600 volts.
- C. Wire for Use in Fluorescent Fixture Wiring Channels: Stranded copper, NEC Type RHH, THHN, or XHHW, rated 90 degC, 600 volts.
- D. Wire for General Interior and Exterior Use: Single conductor, annealed copper, NEC Type THHN/THWN rated 90 degC in dry locations and 75 degC in wet locations, all with 600 volt insulation.
- E. Type MC cable for power and lighting use shall consist of multiple stranded copper conductors as specified above, an insulated grounding conductor and a corrugated aluminum or galvanized steel jacket. Conductors shall be color coded as specified.
- F. All low voltage wiring shall be plenum rated.

2.2 CONNECTORS FOR SPLICING COPPER CONDUCTORS

- A. Connectors for Straight Splicing (Butt Splice) Conductors Up To and Including No. 8 AWG: Uninsulated solderless compression type.

1. Manufacturer: Provide one of the following:

- a. Burndy "Hylink" Type YSVXX
- b. Panduit
- c. Thomas & Betts "Sta-Kon"

- B. Connectors for Straight Splicing Conductors No. 6 AWG and Larger: Uninsulated solderless compression 2-way type.
 - 1. Manufacturer: Provide one of the following:
 - a. Burndy "Hylink" Type YSXX-T
 - b. Thomas & Betts 54500 Series
- C. Connectors for Pigtail Splicing Conductors Up To and Including No. 8 AWG: Solderless type with a metallic insert connector within a plastic insulating cover having a temperature rating of 105 degC, 600 volts.
 - 1. Manufacturer: Provide one of the following:
 - a. Buchanan
 - b. Ideal
 - c. Scotchlok
- D. Connectors for 3-Way Splicing Conductors No. 6 AWG and Larger: Uninsulated solderless compression type.
 - 1. Manufacturer: Provide one of the following:
 - a. Burndy YST-XXXX
 - b. Thomas & Betts 54700 Series
- E. Connectors for termination of motor loads to branch circuits: Set screw type, clean insulation for termination inspection multitap.
 - 1. Manufacturer: Provide one of the following:
 - a. Burndy Clear UNITAP
 - b. Thomas & Betts CSB

2.3 LUGS FOR TERMINATING COPPER CONDUCTORS

- A. Lugs for Terminating Power Conductors Up To and Including No. 8 AWG: Solderless type, manufacturer's standard, unless otherwise specified.
- B. Lugs for Terminating Power Conductors No. 6 AWG and Larger: Solderless compression type, one hole for No. 6 AWG through No. 4/0 AWG inclusive, and two hole for larger sizes.
 - 1. Manufacturer: Provide one of the following:
 - a. Burndy Type YA-L
 - b. Thomas & Betts Series 54000
- C. Lugs for Terminating Control and Switchboard Wiring: Solderless compression type with tinned ring tongue.
 - 1. Manufacturer: Provide one of the following:
 - a. Burndy "Hylug"
 - b. Thomas & Betts "Sta-Kon"

2.4 TERMINAL BLOCKS

- A. Terminal Blocks for Use in Control Wiring of Control Panels and Terminal Cabinets: Molded barrier type rated 30 amperes, 600 volts, with washer head binding screws and white marking strip.
 - 1. Manufacturer: Provide one of the following:
 - a. Cutler-Hammer, Inc., Bulletin 10987
 - b. General Electric EB-5
 - c. Marathon 2000 Series

2.5 INSULATING TAPE

- A. General Use Tape:
 - 1. Tape shall be vinyl all weather designed for continuous operation in -18°C to 105° applications and shall be 7 mils thick.
 - 2. Manufacturer: Provide one of the following:
 - a. Okonite Type CLF Catalog Series 602-20
 - b. 3M Scotch Super 33

2.6 MISCELLANEOUS

- A. Wire Labels for Identification of Conductors.
 - 1. Manufacturer: Provide products of one of the following:
 - a. Brady
 - b. Westline
- B. Lubricating Compound:
 - 1. Manufacturer: Provide products of one of the following:
 - a. American Polywater Corporation
 - b. Ideal 77 Yellow
 - c. Wire Lube

PART 3 - EXECUTION

3.1 GENERAL

- A. Install all wiring in raceway systems unless otherwise specified. Install wiring only in completed raceway systems and when systems are protected from the weather. Install conductors continuous, without splices, between equipments, where possible. Where splices are required, make up splices in boxes; do not use fittings for same.
- B. Install phase and neutral conductors of each branch or feeder circuit in a single conduit except where paralleling circuits are indicated. Install paralleling circuits of identical makeup and length as the paralleled circuit, and terminate conductors at the same location, mechanically and electrically, at both ends, to ensure equal division of the total current between conductors.
- C. All 120 volt branch circuits exceeding 100 feet in length shall be minimum size #10 AWG.

- D. For interior branch circuits, provide a separate neutral conductor for each phase conductor for all circuits. Sharing neutrals between phase conductors shall not be permitted.
- E. Continuously lubricate all non-armored cables of the larger sizes at the pull-in point of conduit systems with an approved compound compatible with conductor insulation or jacket.
- F. Install conductors in such a manner that the bending radius of any wire or cable is not less than the minimum recommended by IPCEA and/or the manufacturer. Do not exceed manufacturer's recommended values for maximum pulling tension applied to any wire or cable.
- G. Connect all power wiring to equipment such that phasing shall be A-B-C-N left to right, top to bottom and front to back, where possible, and permanently identify phasing on the structure or housing adjacent to bus. Phase identification A-B-C is equivalent to transformer phase identification X1-X2-X3 and H1-H2-H3.
- H. Conductors shall be run from terminal to terminal without any splices, except individual devices that have pigtail leads.
- I. Terminate Type MC cable with steel set screw connectors that have integral insulating bushings. Self-locking, twist-in type connectors are not acceptable.

3.2 COLOR CODING, CONDUCTOR AND CABLE IDENTIFICATION

- A. Provide single conductor cables having black insulation for power feeders and subfeeders. Identify individual feeder and subfeeder conductors as to phase connection and voltage by means of wire labels and color coding at each pull box, junction box, manhole, handhole, vault, lighting fixture handhole, splice and termination.
- B. Refer to Section 26 0553 "Identification for Electrical Systems" for conductor and cable identification requirements.

3.3 SPLICES AND TERMINATIONS

- A. Splice and terminate conductors with connectors and lugs as specified for the specific size and type of conductor. Indent all compression type connectors and lugs with tools as recommended by the connector or lug manufacturer.
- B. Thoroughly clean wire ends before connectors or lugs are applied. Install the connector or lug immediately after wire brushing the conductor.
- C. Whenever copper lugs are terminated on aluminum bus, use a Belleville washer and two tin or cadmium plated washers, one on each side in combination with aluminum joint compound on all contacting surfaces. Tighten bolts until Belleville washer is flat.
- D. Insulate all bare surfaces of conductors with a minimum of four layers (half lap in two directions) of electrical insulating tape. On larger splices and terminals, build up connection with electrical insulating putty before applying tape, to eliminate both sharp edges and voids.

3.4 FIELD QUALITY CONTROL

- A. Perform testing on all conductors as indicated in Section 26 0570 "Electrical Testing and Power System Studies".

END OF SECTION 26 0519

SECTION 26 0526 – 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 work of this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Grounding Conductors:
 - a. In Conduit with Phase Conductors: Insulated.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Ground electrical system neutrals and non-current carrying parts of electrical equipment per the minimum requirements of the National Electrical Code, except where additional requirements are indicated or specified.

1.4 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.
- B. Submit shop drawings and complete product data on each item. Coordinate the items, as they relate to the work, prior to submittal. Shop drawings shall include:
 - 1. Ground conductors
 - 2. Grounding connections and fittings

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

- A. Insulated Grounding Conductors: stranded annealed copper insulated with a heat and moisture resistant polyvinyl chloride compound and meeting UL Requirements for Type THWN or XHHW, 75 degC, rated 600 volts, color-coded green. Conductor No. 10 AWG and smaller may be solid in lieu of stranded. Refer to Section 26 0519 for manufacturers.

2.2 GROUNDING CONNECTIONS

- A. Copper Compression Grounding:
 - 1. Manufacturer: Provide products of one of the following:
 - a. Burndy
 - b. Thomas & Betts

B. Grounding Fittings for Bonding a Ground Conductor to Its Own Conduit:

1. Manufacturer: Provide products of one of the following:
 - a. Appleton Type GIB
 - b. Burndy Type NE
 - c. Penn Union Type BD
 - d. O-Z Type GB
 - e. Thomas & Betts Type TIG or 3800 Series

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting branch circuits in EMT or flexible conduit and lighting fixture cord and plug assemblies shall have an equipment grounding conductor.
- B. Provide an equipment grounding conductor, within the raceway along with phase conductors, for all feeders and branch circuits.
- C. Provide an equipment grounding conductor within all flexible conduits.
- D. The metallic enclosures and exposed noncurrent-carrying metal parts of all electrical equipment shall be grounded by connection with an equipment grounding conductor. This includes boxes, panels, lighting fixtures, receptacles, etc.

END OF SECTION 26 0526

SECTION 26 0529 – SUPPORTING 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 work of this Section.

1.2 SUMMARY

- A. This section includes straps, clamps, steel channel, and fastening hardware for supporting electrical work.

1.3 REFERENCES

- A. NECA - National Electrical Contractors Association.
- B. ANSI/NFPA 70 - National Electrical Code.

1.4 SECTION INCLUDES

- A. Conduit and equipment supports
- B. Anchors and fasteners

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

- A. Materials and Finishes: all material provided shall have a protective zinc coating either Electro-Plated (ASTM B633 SCI or SC3), Pre-Galvanized (ASTM A525 coating designation G90) or Hot-Dip Galvanized after fabrication (ASTM A123). The minimum thickness of zinc coating shall be 0.2 mil (5 micrometers).
- B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- C. All structural supports and channels shall be manufactured from ASTM A570 grade 33 steel. The minimum gauge of steel shall #16.
- D. The contractor shall replace all new supports and channels that sag, twist, and or show signs of not providing proper structural support, to the equipment, it is intended for, as determined by the Owner and Engineer. All costs associated with replacing supports and steel channels shall be incurred by the contractor.
- E. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Use expansion anchors, powder actuated anchors and preset inserts.
 - 2. Steel Structural Elements: Use beam clamps and steel ramset fasteners.
 - 3. Concrete Surfaces: Use expansion anchors.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use hollow wall fasteners.
 - 5. Solid Masonry Walls: Use expansion anchors.
 - 6. Sheet Metal: Use sheet metal screws.
 - 7. Wood Elements: Use wood screws.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation."
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit. Electrical equipment shall be adequately supported from elements of the building.
- D. Conduits above suspended ceilings shall not be supported by the ceiling suspension system.
- E. Fabricate supports from structural steel or steel channel. Straps and hangers shall be heavy-duty malleable iron or steel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- F. Install surface-mounted cabinets and panelboards with a minimum of four anchors.
- G. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch (25 mm) off wall.
- H. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION 26 0529

SECTION 26 0533 - RACEWAYS 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 work of this Section.

1.2 SUMMARY

- A. Raceway systems as required, and all equipment and material, including conduit, fittings, boxes, wireways, and cable trays, as indicated or specified.

1.3 SUBMITTALS

- A. Letter of Intent: Submit a letter of intent on each item. Coordinate the items, as they relate to the work, prior to submittal. Shop drawings shall include:
 - 1. Conduit and fittings
 - 2. Boxes
 - 3. Wireways

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Galvanized Steel (RGS) Conduit, Elbows, and Couplings: Zinc-coated hot dip galvanized threaded steel per ANSI C80.1 "Specification for Rigid Steel Conduit, Zinc-Coated" and UL6. Each length of conduit shall be threaded on both ends.
 - 1. Manufacturer: Provide products of one of the following:
 - a. Allied
 - b. Republic
 - c. Wheatland
- B. Electrical Metallic Tubing (EMT): Zinc-coated steel per ANSI C80.3-1977 "Specification for Electrical Metallic Tubing, Zinc-Coated".
 - 1. Manufacturer: Provide products of one of the following:
 - a. Allied
 - b. Republic
 - c. Wheatland
- C. Flexible Steel Conduit: Per UL-1, "Flexible Steel Conduit".
 - 1. Manufacturer: Provide products of one of the following:
 - a. Anaconda
 - b. Electriflex

- D. Liquid-Tight Flexible Steel Conduit: Per UL-1, "Flexible Steel Conduit", with a PVC jacket.

1. Manufacturer: Provide products of one of the following:

- a. Anaconda
- b. Sealtite
- c. Electriflex

2.2 CONDUIT FITTINGS

- A. Fittings for Rigid Galvanized Steel Conduit: Cast or malleable iron bodies, cadmium or zinc-plated, with taper threads, screw attached cover plates, and gaskets when located in areas requiring gaskets as specified in Part 3.

1. Manufacturer: Provide products of one of the following:

- a. Appleton Form 35
- b. Crouse-Hinds Form 8
- c. Steel City/Thomas & Betts
- d. Topaz

- B. Expansion Fittings for Rigid Galvanized Steel Conduit: Cast or malleable iron bodies, with threaded end caps for receiving fixed and movable conduits, metallic pressure packing and copper bonding jumper assembly, and providing for a minimum of 2 inches movement of the conduit in either direction.

1. Manufacturer: Provide products of one of the following:

- a. Appleton Type XJ
- b. Crouse-Hinds Type XJ
- c. O-Z Type AX
- d. Thomas & Betts Type XJG

- C. Couplings and Connectors for EMT: Zinc-plated steel, compression type.

1. Manufacturer: Provide products of one of the following:

- a. Appleton
- b. ETP
- c. Midwest
- d. Steel City/Thomas & Betts

- D. Conduit Unions on Continuous Run:

1. Manufacturer: Provide products of the following:

- a. Erickson

- E. Expansion Fittings for EMT:

1. Manufacturer: Provide products of the following:

- a. Thomas & Betts Type XJG

- F. Fittings for Flexible Steel Conduit: Malleable iron or steel, zinc or cadmium plated, securing the conduit by clamping action around the periphery of the conduit. Do not furnish fittings that anchor the conduit by means of set screws.
1. Manufacturer: Provide products of one of the following:
- a. Appleton
 - b. ETP
 - c. Steel City/Thomas & Betts
- G. Fittings for Liquid-Tight Flexible Steel Conduit: Designed to maintain the liquid-tight feature of the installation.
1. Manufacturer: Provide products of one of the following:
- a. Appleton ST Series
 - b. ETP
 - c. Thomas & Betts 5331 to 5360
- H. Locknuts for Rigid Steel Conduit: Malleable iron or steel, zinc or cadmium plated.
- I. Bushings for 1 Inch and Smaller Rigid Steel Conduits: Insulating plastic type of non-burnable thermosetting phenolic, conforming to Underwriters' Laboratories requirements. Do not furnish non-rigid plastic bushings.
- J. Bushings for 1-1/4 Inch and Larger Rigid Steel Conduits: Malleable iron or steel, zinc or cadmium plated, with insulating insert of thermosetting plastic as specified for smaller conduit bushings, molded and locked into the bushing ring.

2.3 OUTLET BOXES

- A. Sheet Steel Boxes: Galvanized or sherardized stock not less than No. 14 gage, with knockout openings, single or multiple gang, with extensions, adapters, plaster rings, tile covers, fixture studs and cover plates. Furnish accessories with same gage and finish as specified for boxes, except where special finishes are specified for covers and device plates in Section 26 2726. Provide sizes per NEC requirements for wiring space, except where minimum sizes are specified under Part 3.
1. Manufacturer: Provide products of one of the following:
- a. Appleton
 - b. RACO
 - c. Steel City
- B. Cast or Malleable Iron Boxes: Galvanized or cadmium plated, single or multiple gang, with taper threaded hubs, adapters and cover plates. Furnish cast metal, galvanized or cadmium plated accessories, except where special device plates are specified in Section 26 2726. Furnish gaskets when located in areas requiring gaskets as specified in Part 3. Provide sizes per NEC requirements for wiring space, except where minimum sizes are specified under Part 3.
1. Manufacturer: Provide products of one of the following:
- a. Appleton
 - b. Crouse-Hinds
 - c. Pyle-National
 - d. Russelstoll
 - e. Steel City/Thomas & Betts

2.4 PULL AND JUNCTION BOXES

- A. Boxes Less than 5 Inches by 5 Inches: Conform to requirements specified for Outlet Boxes.
- B. Sheet Metal Boxes: Code gage, full seam welded with bent-in flanges seam welded at corner joints, screw fastened cover of same gage as box. Fasten cover with brass machine screws. Galvanize box and cover after fabrication. Provide sizes conforming to NEC requirements for wiring space, except where boxes of larger size are indicated. Furnish gaskets when located in areas requiring gaskets as specified in Part 3.
- C. Cast or Malleable Iron Boxes: Code gage, with threaded hubs or conduit bosses for field drilling and tapping, screw fastened cover of same gage as box. Fasten cover with brass machine screws. Galvanize box and cover after fabrication. Provide sizes conforming to NEC requirements for wiring space, except where boxes of larger size are indicated. Furnish gaskets when located in areas requiring gaskets as specified in Part 3.
 - 1. Manufacturer: Provide products of one of the following:
 - a. Hoffman
 - b. O-Z

2.5 MISCELLANEOUS

- A. Trapeze Hangers
 - 1. Manufacturer: Provide products of one of the following:
 - a. Kindorf
 - b. Powerstrut
 - c. Unistrut
- B. Shielding Paint
 - 1. Manufacturer: Provide products of one of the following:
 - a. Thomas & Betts "KopR-Shield"
- C. Sealant: Single component, non-sage urethane:
 - 1. Manufacturer: Provide products of one of the following:
 - a. Sika Corporation "Sikaflex 1a"
 - b. Pecora Corporation "Dynatrol 1"
 - c. Sonneborn "Sonolastic NP-1"
 - d. Tremco "Dymonic"

PART 3 - EXECUTION

3.1 CONDUIT SYSTEMS

- A. Install Rigid Galvanized Steel (RGS) conduit for all main feeders which includes feeders to switchgear, switchboards, distribution panels, motor controls, panelboards and distribution transformers.
- B. Install RGS conduit for all feeders 2" in diameter or larger.
- C. Install RGS conduit for conduit in "unfinished" or "open" areas up to 10'-0" above finished floor.

- D. Install RGS conduits for conduits imbedded in the floor slab. Maximum size of conduits imbedded in floor slabs shall be 1-1/4" diameter unless otherwise specified. Conduits imbedded in floor slabs shall not cross each other.
- E. Install RGS conduit for conduit elbows used to transition from below the slab and for all RGS conduit imbedded in the slab to vertical risers passing through the floor slab.
- F. EMT compression type connectors and couplings shall be used for all EMT conduits.
- G. All low voltage and control wiring shall be installed in conduit.
- H. Install EMT concealed in wall cavities in office and similarly "finished areas," above suspended ceilings and in "unfinished areas" 10'-0" above finished floor.
- I. Install flexible conduit in lieu of RGS or EMT for service to individual recessed fixtures, 1/2 inch minimum size. Use liquid-tight type of flexible conduit in lieu of non-jacketed flexible conduit in damp or wet locations.
- J. Install liquid-tight flexible steel conduit for final connection to distribution transformers for final connections to all motors and other equipment subject to vibration or movement. Flexible conduits shall not exceed 6'-0" in length.
- K. Install conduit systems as indicated, as required by the NEC, and as specified. Install conduit sizes as indicated. Where conduit sizes are not indicated, install sizes per NEC requirements, except do not use conduit sizes smaller than 3/4 inch. The use of 1/2" conduit is permitted from receptacle outlet boxes and switch outlet boxes to the nearest junction mounted in the ceiling space. 3/4" conduit minimum shall be used from the panelboards to the junction boxes and between junction boxes. Use 1/2 inch fixture stems optionally, unless otherwise indicated.
- L. Install conduit concealed in office and similar finished areas, and exposed in all other areas unless otherwise indicated or specified.
- M. Install all exposed and concealed conduit runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Keep conduit at least six inches away from parallel runs of high temperature surfaces, such as steam or hot water pipes and do not run conduit directly under cold water lines.
- N. Group conduit for common support, where indicated and elsewhere as directed by the Architect-Engineer.
- O. Do not install crushed or deformed conduits and avoid trapped runs in damp or wet locations. Take care to prevent the entrance of water and the lodging of concrete, plaster, dirt or trash in conduit, boxes, fittings and equipment during the course of construction. Free conduit of obstructions or replace the conduits. Where conduit joints occur in concrete slabs, or in damp or wet locations, make joints watertight by applying an approved compound on the entire thread area before assembling. Draw up all conduit joints as tightly as possible. Cap exposed empty conduits which do not terminate in outlets, panels, cabinets, etc. with standard galvanized plumbers pipe caps. Plug empty conduits which terminate flush with floors or walls with flush coupling and brass plug.
- P. Install conduit sleeves for all exposed conduits and cables passing through walls, ceilings or floors, and fill the void between sleeve and conduit with sealant flush with the end of the sleeve to seal the opening.
 - 1. For conduit sleeves passing through fire rated walls, floors or ceilings, comply with requirements of 07 8413 "Firestop Systems".

- Q. Make changes in direction of runs with symmetrical bends, fittings or pull boxes. Do not use bends around outside corners; use fittings for same. Install elbows, bends and offsets having a minimum radius of curvature of 24 inches for 2 inch and 2-1/2 inch conduit, and 36 inches for 3 inch and larger conduit. Except where conduit runs are shown in exact detail, install pull points at not greater than 200 foot intervals in straight runs. Where bends are included between pull points, reduce this maximum permissible 200 foot separation between pull points by 50 feet for each 90 degree bend and 25 feet for each 45 degree bend. Figure deductions for all other angle bends on a similar basis. When bends are made in the field, make bends with an approved hickey or conduit bending machine. Make bends in 1-1/4 inch and larger conduits with standard conduit ells where possible.
- R. Provide conduit nipples with two independent sets of threads. Do not use running threads on any part of the conduit system. Where conditions require joining two fixed conduits into a continuous run, use a conduit union, in place of running threads and coupling.
- S. Final connections to recessed lighting fixtures and under-counter lights shall be 1/2" minimum flexible metallic conduit, manufactured wiring systems, or Type MC cable.
 - 1. Terminate Type MC cable with steel set screw connectors that have integral insulating bushings. Self-locking, twist-in type fittings are not acceptable.
 - 2. In new partitions and walls, the final connections may be made with Type MC cable. Type MC cable shall:
 - a. Be run to a box immediately above the accessible ceiling. The box size shall not exceed 4-11/16" square.
 - b. Conduit shall be used for the entire run, from this junction box, to the power source, load (lights), etc.
 - c. No more than three circuits may be run through any given junction box.
 - d. Secure the Type MC cables in the wall cavity.
 - e. Type MC cables shall be as short as possible.
 - 3. In existing partitions and walls where the surface is not being otherwise opened up, the final connections to new devices may be made using flexible metallic conduit or Type MC cable.
- T. Install expansion fittings in exposed conduit runs of excessive length, where conduits cross building expansion joints, and where indicated.
- U. Install double locknuts and bushings on all rigid conduit terminations into threadless openings. Increase length of conduit threads at terminations sufficiently to permit the bushing to be fully seated against the end of the conduit.
- V. Use one hole malleable iron galvanized pipe straps for support of single conduits, or clevis type hangers. Support groups of conduit on trapeze hangers. Use threaded rod or pipe for hanger support. Do not use perforated strap or wire for conduit or hanger support. Use beam clamps or malleable iron or wrought steel with hook rods to grip the beam flange for conduit or hanger support; do not use C-clamp type fittings. Support exposed conduit at least every 8 feet if smaller than 2 inch, and every 10 feet if 2 inch and larger unless otherwise noted.
- W. All wiring shall be installed in conduit. The use of MC cable, AC cable or BX cable shall not be permitted.
- X. Where fire alarm system wiring is run in conduit, conduits shall be dedicated to fire alarm system. Conduits and outlet boxes shall be marked and labeled.
- Y. All emergency and exit lighting wiring shall be installed in dedicated conduits. Conduits and outlet boxes shall be marked and labeled.

- Z. All conduit systems and circuits shall be provided with an equipment grounding conductor.

3.2 OUTLET, SWITCH, JUNCTION AND PULL BOXES

- A. Outlet Boxes for Use with Rigid Steel Conduit: Sheet steel for flush or concealed work in dry locations; cast or malleable iron in exposed, damp or wet locations. Do not use sheet steel outlet boxes in utility areas.
- B. Outlet Boxes for Use with Electrical Metallic Tubing: Sheet steel for flush or concealed work; cast or malleable iron for exposed locations.
- C. Flush Mounted Boxes: For single gang outlets and two gang outlets, use boxes not less than 4 inches square and 2-1/8 inches deep with single gang and two gang plaster reducing ring. For multiple outlets, use gang type boxes not less than 2-1/4 inches deep. Plaster rings shall not be less than 3/4 inches deep. For ceiling outlets in concrete slabs, use boxes not less than 3 inches deep.
- D. Gaskets: Provide cover gaskets for boxes in damp or wet locations and in utility areas.
- E. Pull and Junction Boxes for Use with Each Type of Conduit: As specified for outlet boxes for each conduit type under above paragraphs.
- F. Install boxes in the wiring or raceway systems as required for pulling of wires, making connections, and mounting of devices and fixtures.
- G. Install extension rings, adapters, raised covers and plaster rings on flush mounted boxes as required. Equip flush mounted boxes in masonry block or tile walls with tile covers.
- H. Install separate concealed boxes for semi-flush or recessed fixtures when required by the fixture terminal operating temperature. Make boxes readily accessible on removal of the fixture or provide ceiling access panels as approved by the Architect-Engineer.
- I. Locate outlets in office and other finished areas with due regard for the finish and interior architectural treatment so that outlets are centered with respect to panels, joints or moldings, and so that plaster rings, frames and tile covers are properly located with respect to the finished surface.
- J. Install outlets for wall switches controlling lighting on the latch side of door where possible.
- K. Support boxes independent of conduit and secure rigidly in place. Install boxes used for fixture support such that they are capable of carrying 100 pounds.
- L. In concrete, anchor boxes securely to reinforcing steel and to forms to prevent shifting when concrete is placed.
- M. Above suspended ceilings, support boxes to the building steel or structural floor above and independent of the ceiling pads; flush mounted boxes for suspended ceilings fasten boxes to the ceiling support system by bar hanger or other approved support; flush boxes in drywall ceilings fasten boxes to ceiling support system by bar hanger or other approved support system.
- N. Unused opening in boxes shall be effectively closed. All boxes shall be provided with covers made of the same thickness and material as specified for the walls of the box.
- O. Boxes shall be rectangular or octagonal having a flat bearing surface at each knockout. Boxes shall be sized in accordance with the National Electrical Code.

END OF SECTION 26 0533

SECTION 26 0553 - IDENTIFICATION 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. Section Includes:
 - 1. Equipment identification nameplates
 - 2. Raceway identification
 - 3. Power and control cable identification
 - 4. Miscellaneous identification products

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 [and IEEE C2].
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION NAMEPLATES

- A. Engraved, Plastic Laminate or Laminated Acrylic: Punched or drilled for screw mounting. Black engraved letters on a white face. Minimum letter height shall be **1/4 inch**.

2.2 RACEWAY IDENTIFICATION

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits as specified voltages:
 - 1. Legend for Systems below 600V: Indicate voltage.
- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

- E. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4 inch black stripes on 10 inch centers diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.
- F. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

2.3 POWER AND CONTROL CABLE IDENTIFICATION

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- E. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.4 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black except where used for color-coding.
- B. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F.
 - 5. Color: Black.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.

- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at **50 foot** maximum intervals in straight runs, and at **25 foot** maximum intervals in congested areas.
- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. In Spaces Handling Environmental Air: Plenum rated.
- I. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 EQUIPMENT IDENTIFICATION NAMEPLATES

- A. Equipment Identification Nameplates: On each unit of equipment, install unique designation label that is consistent with one line diagram tag nameplates, wiring diagrams, schedules, and the Operation and Maintenance Manual
 - 1. Labeling Instructions:
 - a. Indoor and Outdoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with **1/4 inch** high letters on **1-1/2 inch** high label.
 - b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - c. Fasten nameplates with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 - 2. Equipment to Be Labeled:
 - a. Feeder breakers
 - b. Feeder switches
 - c. Panelboards: Both panelboard identification label and typewritten directory of circuits.
 - d. Enclosures and electrical cabinets
 - e. Access doors and panels for concealed electrical items
 - f. Emergency system boxes and enclosures
 - g. Enclosed switches
 - h. Enclosed controllers
 - i. Push-button stations

3.3 RACEWAYS AND CONDUCTOR IDENTIFICATION SCHEDULE

- A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits 100 amperes or more and 120 volts or more to ground:
 1. Self-adhesive vinyl tape applied in bands. Install labels at **30 foot** maximum intervals.
- B. Accessible Raceways, Cables, Junction Box Cover Plates and Pull Box Covers:
 1. Self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - a. Emergency power
 - b. Power
 - c. UPS
- C. Conductor Identification, 600 V or Less:
 1. Identify individual phase conductors, neutral conductor and ground conductor of branch power and lighting circuits as to phase and system voltage by means of color coding in conformance with Sections 200-6 and 210-5 of the NEC.
 2. Use the following identification scheme unless there are existing schemes being utilized by the Owner:

Phase			Neutral		Equipment Grounding Conductor	System
A	B	C	Normal Power	Emergency Power		
X	Y	Z	N	N	GRD.	Any Voltage
Black	Red	Blue	White	White/Red tracer	Green	120/208 Volt
Brown	Orange	Yellow	Gray	Gray/Red tracer	Green/Yellow Tracer	277/480 Volt
 3. Where color schemes deviate from above, submit color schemes for approval of the Architect-Engineer prior to implementation. Provide conductor color coding by means of colored insulating materials or by means of colored wire labels attached to individual conductors in all outlet, pull or junction boxes and at all terminations.
 4. Install color coding scheme labels at each switchboard, panelboard, distribution panel, power panel and motor control center.
 5. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of **6 inches** from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Identify cables entering or exiting conduits, passing through pull boxes, at each pullbox and at each termination location.
- E. Designate source and load, or feeder or cable identification on tags.
- F. Auxiliary Systems Conductor Identification:
 1. Identify field-installed alarm, control, and signal connections.
 2. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

3. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
4. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

END OF SECTION 26 0553

SECTION 26 0570 – ELECTRICAL TESTING

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 work of this section.

1.2 SUMMARY

- A. General Scope:
 - 1. It is the intent of these tests to assure that all electrical equipment, both contractor and owner supplied, is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.
 - 2. The tests and inspections shall determine suitability for energization.
- B. Applicable Codes, Standards and References:
 - 1. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.
 - a. American National Standards Institute - ANSI
 - 1) ANSI C2: National Electrical Safety Code
 - 2) ANSI Z244-1: American National Standard for Personnel Protection
 - b. American Society for Testing and Materials - ASTM
 - c. Association of Edison Illuminating Companies - AEIC
 - d. Electrical Apparatus Service Association - EASA
 - e. Institute of Electrical and Electronic Engineers - IEEE
 - f. Insulated Cable Engineers Association - ICEA
 - g. International Electrical Testing Association - NETA
 - h. National Electrical Manufacturer's Association - NEMA
 - i. National Electrical Code - NEC
 - j. National Fire Protection Association - NFPA
 - 1) ANSI/NFPA 70B: Electrical Equipment Maintenance
 - 2) NFPA 70E: Electrical Safety Requirements for Employee Workplaces
 - 3) ANSI/NFPA 70: National Electrical Code
 - 4) ANSI/NFPA 78: Lightning Protection Code
 - 5) ANSI/NFPA 101: Life Safety Code
 - k. Occupational Safety and Health Administration - OSHA
 - 1) OSHA Part 1910; Subpart S, 1910.308
 - 2) OSHA Part 1926; Subpart V, 1926.950 through 1926.960
 - l. Underwriters Laboratories, Inc. - UL
 - m. State and Local Codes and Ordinances

2. All inspections and tests shall utilize the following references:

- a. Project Design Specifications.
- b. Project Design Drawings.
- c. Manufacturer's instruction manuals applicable to each particular apparatus.

C. Preliminary Inspections and Tests:

1. Visual inspections of electrical equipment, wire checks of factory wiring and any other preliminary work required to prevent delays during performance of electrical acceptance tests.

D. Operating Tests:

1. Those tests performed on all electrical equipment installed under Division 26 Sections, and under other Sections, to show that the electrical equipment will perform the functions for which it was designed.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Refer to Section 26 0500, "Common Work Results for Electrical".

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 CONTINUITY TESTS

- A. Perform continuity tests on all new wiring.

3.2 TESTS ON LOW VOLTAGE PANELBOARDS (600V MAXIMUM)

A. General:

1. Check and test all ground connections per "Tests on Grounding".

B. Visual and Mechanical Inspection:

1. Compare equipment nameplate data with drawings and specifications. Report differences in test report and include on contractor's "as-built" drawings.
2. Inspect physical and mechanical condition.
3. Inspect anchorage, alignment, grounding, and required area clearances.
4. Verify the unit is clean.
5. Verify that fuse and/or circuit breaker sizes and types correspond to drawings.

C. Operational Tests on Each Breaker:

1. Inspect each breaker for correct alignment, freedom from binding, and good contact.

3.3 TESTS ON CABLES, LOW-VOLTAGE (600V MAXIMUM)

A. General:

1. Provide visual and mechanical inspection of all cables.
2. Provide a continuity test for all feeders.
3. Verify that phase identification was provided and its accuracy for each power feeder.

4. Verify identification of all lighting circuits, 208 volt circuits and 120 volt circuits on the panel directories.
5. Test and verify thorough operational tests that all lighting, 208 volt circuits and 120 volt circuits perform all the functions for which they were designed.

B. Visual and Mechanical Inspection:

1. Inspect and compare cable data including size and quantity of cables with drawings and specifications. Report differences in test report and include on contractor's "as-built" drawings.

3.4 TESTS ON GROUNDING

- A. General: Inspect ground conductors and connections for conformance with design specifications and for satisfactory workmanship.

3.5 TESTS ON LIGHTING FIXTURES

- A. Lighting fixtures shall be checked for proper assembly, proper components, straight row alignment, proper aiming, and the absence of light leaks.

3.6 TESTS ON LIGHTING CIRCUITS

- A. Lighting circuits shall be checked for proper switching, for proper circuiting according to the design documents, and for circuiting that matches the lighting panel schedule.

3.7 TESTS ON SPECIAL SERVICE SYSTEMS

- A. Perform operating tests on all special service systems, including fire alarm system, to prove that all design functions are satisfactorily performed.

END OF SECTION 26 0570

SECTION 26 0923 – 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 work of this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Lighting control devices as required.
 - 2. The objective of this section is to ensure the proper installation of the following lighting control devices:
 - a. Occupancy sensors
 - 3. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of completely operational occupancy sensor lighting control devices, as described herein.
 - 4. The occupancy sensor based lighting control devices shall accommodate all conditions of space utilization and all irregular work hours and habits.
 - 5. The location and quantities of sensors shown on the Drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. Provide additional sensors as required to properly and completely cover the respective room.

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.
- B. Product Data: Submit product data on each item. Coordinate the items, as they relate to the work, prior to submittal. Include the following:
 - 1. Wallbox dimmers
 - 2. Wall switch occupancy sensors
 - 3. Occupancy sensors
- C. Shop Drawings: Show installation details for occupancy sensors.
 - 1. Lighting plans showing complete layout, location, orientation, and coverage area of each sensor. The locations and quantities of sensors indicated on the Drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. Provide layout shop drawings indicating all additional sensors as required to properly and completely cover the respective areas.
 - 2. Interconnection diagrams showing field-installed wiring.

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. Products supplied shall be from a single manufacturer that has been continuously involved in the manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.

- C. All components shall be U.L. listed and meet all state and local applicable code requirements.
- D. Wall switch products shall be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

1.5 WARRANTY

- A. Contractor shall warrant all equipment furnished in accordance with this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The supplier's obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty shall be for a minimum period of one (1) year.

1.6 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

1.7 SYSTEM OPERATION

- A. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the occupancy sensor system.
- B. It shall be the manufacturer's responsibility to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy system. A minimum of four (4) hours at the jobsite building shall be included for training.

PART 2 - PRODUCTS

2.1 DUAL TECHNOLOGY OCCUPANCY SENSOR

- A. The Dual Technology sensor shall be capable of detecting presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared (PIR) heat changes.
- B. Sensor shall utilize dual sensing verification for coordination between technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.
- C. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off.
- D. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize signal processing which automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
- E. Detection shall be maintained when a person is seated and performing normal work tasks, such as reading or writing at a desk.
- F. Sensor shall be capable of corner mounting to a wall or ceiling in order to eliminate detection through open doorways and outside of controlled area. To provide superior small motion detection and immediate

activation upon entry, coverage of both technologies must be complete and overlapping throughout the controlled area.

- G. To avoid false ON activations and to provide high sensitivity to minor motion, pulse count processing and detection signature analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.
- H. Sensor shall utilize mixed signal technology to provide immunity to RFI and EMI.
- I. Sensor shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens to ensure high sensitivity to small motion at the desktop. The lens shall offer superior performance in the infrared wavelengths and filter short wavelength IR, such as that emitted by the sun and other visible light sources. The surface of the lens shall be smooth to avoid dust and residue build up
- J. Sensor shall have an adjustable, digital time delay of 30 sec to 20 min. Each sensing technology shall have an independent sensitivity adjustment or be electronically tuned to alter sensitivity.
- K. Sensor shall have an additional single-pole, double-throw isolated relay with normally open, normally closed, and common outputs. The isolated relay shall be used with HVAC control, data logging, and other control options.
- L. Sensor shall incorporate field-selectable logic configurations which allows for space utilization changes and/or other special field conditions.
- M. Provide ceiling-mounted dual technology occupancy sensors in classrooms, private offices and conference rooms with ceilings up to 12 feet high:
 - 1. Leviton OSC10-M0W sensor and power pack.
 - 2. Sensor Switch CM PTD 9 and power pack.
 - 3. Watt Stopper DT-300 sensor and power pack.

2.2 POWER PACKS

- A. Power pack shall be a self-contained transformer and relay module. Power pack shall have ½" snap-in nipple for ½" knockouts and mounting on outside of enclosure.
- B. Power pack shall have two (2) dry contacts. The primary contact is capable of switching 20 amp LED load @ 120 VAC, 60 Hz; 1 hp @ 120-250 VAC, 60 Hz. The secondary contact is rated 1 amp maximum @ 30 VDC. Power pack shall have primary dual-voltage inputs of 120/277 VAC. Power pack shall provide a 24 VDC, 150 mA output, with the relay connected.
- C. Power pack shall be capable of parallel wiring without regard to AC phases on primary. Power pack can be used as a stand-alone, low voltage switch, or can be wired to sensor for auto control.
- D. Power pack shall have hold-ON and hold-OFF inputs for integration with lighting control panels, building management systems, and other building systems.
- E. Power pack shall have overcurrent protection if the low voltage current drawn exceeds 150 mA. In the event of an overcurrent, the low voltage output current shuts down and the LED will blink to indicate a fault condition. Power pack shall utilize Zero Crossing Circuitry to protect from the effects of inrush current and increase product longevity.
- F. Power pack shall have an LED to indicate status of relay.
- G. Power pack shall be UL 2043 plenum rated and shall have low voltage Teflon coated leads, rated for 300 volts.

H. Manufacturer: Provide the following:

1. Watt Stopper C120E-P
2. Sensor Switch MP-20-TP
3. Leviton OSP20-0DO with OSA20-RA0 HVAC relay

2.3 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Division 26 Sections.
- B. Control wiring between sensors and control units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.
- C. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

2.4 DEVICE PLATES

- A. Refer to Wiring Devices section.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount equipment at locations indicated.
- B. Install plates on flush mounted outlets with all four edges in continuous contact with finished wall surfaces without the use of plaster mats or similar devices. Do not use plaster or similar fillings. Install plates vertically, unless otherwise noted, with an alignment tolerance of 1/16 inch.
- C. Sensor Installation:
1. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the Drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
 2. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the owner's facility, to verify placement of sensors and installation criteria.
 3. Proper judgment shall be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.
 4. Ceiling and wall mounted sensors shall be mounted 5'-0" minimum from supply air diffusers.
- D. Wiring Installation:
1. Wiring Method: Comply with Division 26 Sections. .
 2. Wiring Within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
 3. Size conductors according to lighting control device manufacturer's written instructions.

4. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
 5. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. Identification:
1. Identify components and power and control wiring according to Division 26 Sections.
- F. Field Quality Control:
1. Perform the following field tests and inspections and prepare test reports:
 - a. After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - b. Operational Test: Verify actuation of each sensor and adjust time delays.
 2. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
 3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 26 0923

SECTION 26 2413 - PANELBOARDS

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 work of this Section.

1.2 SUMMARY

- A. Distribution systems including panelboards and circuit breakers, as indicated or specified. Provide equipment supports and identification as specified.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 01 Specification Sections.
- B. Submit shop drawings and complete product data on each item. Coordinate the items as they relate to the work, prior to submittal. Shop drawings shall include:
 - 1. All panelboards

PART 2 - PRODUCTS

2.1 PANELBOARDS FOR 208/120 VOLT LIGHTING AND RECEPTACLE SERVICE

- A. General Description: Dead front type, per NEMA Standard PB 1 and UL 67, and consisting of a 3 phase 4 wire solid (aluminum) (copper) neutral main bus with main lugs or main circuit breaker as indicated, and branch circuit breakers, all in a flush, surface or column mounted steel cabinet as indicated.
- B. Ratings: As indicated on the panel schedules.
- C. Circuit Breakers: Bolt-in molded plastic case type, AC rated 1, 2, or 3 pole as indicated, quick-make, quick-break, with trip-free operating handle, position indication and thermal magnetic trip device. Furnish 2 and 3 pole breakers having a common operating handle and common trip mechanism.
- D. Enclosure: NEMA 1, 1A (gasketed) or 12 in factory areas and NEMA 1 in other areas, unless otherwise noted, minimum 20 inch wide box except column type, and with trim having hinged door with flush latch and cylinder lock. Key all locks alike or to the existing master system. Furnish cable duct and pullbox with neutral for column mounting panels. Galvanize or phosphatize and prime and finish paint in manufacturer's standard finish, including cable duct and pullbox. Galvanize all recessed boxes.
- E. Spaces: When future circuit breakers designated as "space" are noted, equip the panelboard with bus and minimum hardware ready to receive future breakers. Furnish a blank removable spacer plate to cover the "space" until future use.
- F. Circuit Directory: Heavy plastic covered metal frame and card on inside of door.
- G. Lugs for Mains: Compression type; manufacturer's standard.

H. Manufacturer: Provide one of the following:

1. Cutler-Hammer/Westinghouse "PRL-1" and "PRL-1LX"
2. General Electric "AQ" and "AQC"
3. Siemens-ITE "S1"
4. Square D "NQOD" and "NQOD-LX"

PART 3 - EXECUTION

3.1 GENERAL

- A. Mount panelboards at uniform heights throughout the building as indicated, and such that the distance from the floor to the center of the top switch or circuit breaker does not exceed 78 inches. Install handle locking devices on all breakers for night lighting, emergency lighting and similar circuits.

3.2 EQUIPMENT SUPPORTS

- A. Mount all electrical equipment, not self supporting, including panelboards, circuit breakers, starters, safety switches, and similar equipment, securely to walls, columns and machine frames with 1/4 inch minimum separation from same, and provide all necessary spacers, brackets, structural pieces, inserts, anchors and bolts for this purpose. Provide supports for truss structural pieces, inserts, anchors and bolts for this purpose. Provide supports for truss mounted and wall mounted transformers. Anchor all self-supporting equipment securely to floors and to supporting steel where such supports are indicated or required. Provide structural channels in concrete floors for support and leveling of primary switchgear, and power switching center, and unit substations.

3.3 EQUIPMENT IDENTIFICATION

- A. Provide identification on all electrical equipment installed, including panelboards, circuit breakers, starters, switches and contactors, in accordance with the following:
1. Nameplates: White laminated plastic engraved with 1/2" high black letters. Secure nameplates mechanically. Adhesive applied nameplates are not acceptable.
 2. Provide a neatly typed directory for each panelboard indicating circuit number and equipment served. Provide a clear plastic protective cover.

3.4 TOUCH-UP PAINTING

- A. On all equipment installed, touch-up paint all manufacturer's standard finished equipment surfaces damaged during construction to "as new" condition with original manufacturer's finish paint.

END OF SECTION 26 2413

SECTION 26 2726 – 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 work of this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Lighting control and receptacle services as required, and all materials and equipment, including line-voltage switches, receptacles, device plates, as indicated or specified.

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.
- B. Product Data: Submit product data on each item. Coordinate the items, as they relate to the work, prior to submittal. Include the following:
 - 1. Line voltage wall switches and plates.
 - 2. All receptacles including device plates.

PART 2 - PRODUCTS

2.1 LINE VOLTAGE WALL SWITCHES

- A. Switches for Controlling Lighting Directly on AC systems in General: Toggle-operated, white specification grade, composition base, heavy duty, flush, quiet type, with provision for back and side wiring, and rated 20 amperes, 120/277 volts AC.
 - 1. Manufacturer: Provide one of the following:
 - a. Arrow Hart AH1200 Series
 - b. Bryant 4900 Series
 - c. Hubbell 1220 Series
 - d. Leviton 1200 Series
 - e. Pass & Seymour 20AC Series

2.2 CONVENIENCE RECEPTACLES

- A. 15 Ampere Duplex Convenience Receptacles for 120 Volt, Single Phase Service: Two straight blade, 2 pole, 3 wire, NEMA configuration 5-15R receptacles rated 15 amperes, 125 volts, NEMA performance standard, specification grade, for back and side wiring, white color.
 - 1. Manufacturer: Provide one of the following:
 - a. Arrow-Hart 5262
 - b. Bryant 5262
 - c. Hubbell 5262
 - d. Leviton 5262
 - e. Pass & Seymour 5262

- B. 20 Ampere Duplex Convenience Receptacles for 120 Volt, Single Phase Service: Two straight blade, 2 pole, 3 wire, NEMA configuration 5-20R receptacles rated 20 amperes, 125 volts, NEMA performance standard, specification grade, for back and side wiring, white color.
1. Manufacturer: Provide one of the following:
 - a. Arrow Hart 5362
 - b. Bryant 5362
 - c. Hubbell 5362
 - d. Leviton 5362
 - e. Pass & Seymour 5362
- C. 15 Ampere Duplex Ground Fault Circuit Interrupter (GFCI) Convenience Receptacles for 120 Volt, Single Phase Service: Two straight blade, 2 pole, 3 wire grounding, NEMA configuration 5-15R receptacles rated 15 amperes, 125 volts, NEMA performance standard, specification grade, with provisions for back and side wiring, white color.
1. Units shall have a test and reset button on the face of the receptacles and visible indication of a tripped condition.
 2. Units shall have line and load terminal screws such that connection to load terminals shall provide feed through ground fault protection for "downstream" receptacles and/or loads connected to these terminals.
 3. All receptacles shall be Underwriters' Laboratories, Listed under 498 Receptacle requirements and 943 Class A requirements.
 - a. Manufacturer: Provide one of the following:
 - 1) Arrow-Hart GF5242
 - 2) Bryant GFR52FT
 - 3) Hubbell GF5262
 - 4) Leviton 6598
 - 5) Pass & Seymour 1591-S
- D. 20 Ampere Duplex Ground Fault Circuit Interrupter (GFCI) Convenience Receptacles for 120 Volt, Single Phase Service: Two straight blade, 2 pole, 3 wire grounding, NEMA configuration 5-20R receptacles rated 20 amperes, 125 volts, NEMA performance standard, specification grade, with provisions for back and side wiring, white color.
1. Units shall have a test and reset button on the face of the receptacles and visible indication of a tripped condition.
 2. Units shall have line and load terminal screws such that connection to load terminals shall provide feed through ground fault protection for "downstream" receptacles and/or loads connected to these terminals.
 3. All receptacles shall be Underwriters' Laboratories, Listed under 498 Receptacle requirements and 943 Class A requirements.
 - a. Manufacturer: Provide one of the following:
 - 1) Arrow-Hart GF5342
 - 2) Bryant GFR53FT
 - 3) Hubbell GF5362
 - 4) Leviton 6598
 - 5) Pass & Seymour 2091-S

2.3 DEVICE PLATES

- A. Device Plates in Dry Interior Areas: Stainless steel No. 302 brushed finish.
- B. Screws: Provide screws having a finish matching the plate.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount equipment at locations indicated.
- B. Install receptacles in outlet boxes as specified in Section 26 0533 "Raceways and Boxes for Electrical Systems" unless otherwise specified in this Section. Mount receptacles and switches at uniform heights above the floor for various areas as indicated.
- C. Install plates on flush mounted outlets with all four edges in continuous contact with finished wall surfaces without the use of plaster mats or similar devices. Do not use plaster or similar fillings. Install plates vertically, unless otherwise noted, with an alignment tolerance of 1/16 inch.
- D. Device plates shall be installed so as to make continuous contact around the perimeter of the plate.
- E. Install devices and assemblies plumb and secure.
- F. Install wall plates when painting is complete.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.
- H. Protect devices and assemblies during painting.
- I. Receptacles on branch circuits where two or more receptacles are installed for cord and plug connected loads, shall be 15 ampere, 125 volts.
- J. Receptacles shall have an ampacity rating equal to the branch circuit rating or branch circuit where only one (1) receptacle is installed.
- K. Receptacles installed outdoors at grade, outdoors on roof tops, in kitchens or toilet rooms where water is present within 6'-0" from the outlets shall be GFCI type or protected by a GFCI receptacle located within the same room. All receptacles outdoors or installed on roof tops or outdoors at grade shall be GFCI type.

3.2 CONNECTIONS

- A. Connect wiring device grounding terminal to outlet box with bonding jumper.
- B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- C. Replace damaged or defective components.

3.4 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 26 2726

SECTION 26 2913 - ENCLOSED CONTROLLERS

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 work of this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Motor control as required, and all material and equipment, including:
 - a. Control devices.
 - b. Fuses.

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.
- B. Submit shop drawings and product data on the following:
 - 1. Three phase magnetic motor starters full voltage combination type.
 - 2. Single phase manual motor starters fractional horsepower type.
 - 3. Control devices.
 - 4. Fuses.

PART 2 - PRODUCTS

2.1 THREE PHASE MAGNETIC MOTOR STARTERS FULL VOLTAGE COMBINATION TYPE

- A. Single-Speed Non-Reversing Starters: Per NEMA Standard ICS and consisting of a fused or non-fused disconnect switch, motor circuit protector, or circuit breaker as indicated, a full voltage magnetic starter, thermal overloads, control transformer and control devices as indicated and as specified, all mounted and wired in a NEMA 1 enclosure in other indoor areas and NEMA 3R in outdoor areas unless otherwise indicated.
 - 1. Fused Disconnect Switch: 600 volt, 3 pole, single throw, visible blade, NEMA "HD" heavy duty, quick-make, quick-break type, horsepower rated in ratings up to 200 amperes, with continuous current fuse ratings as indicated. Where ratings are not indicated, provide fuse clips to accommodate a dual element type fuse as specified and having a minimum current rating of 150% of the motor full load current, with switch of equivalent rating. Silver or cadmium plate all contact surfaces including fuse clips.
 - 2. Interlocking: Equip switch or breaker with an external operating handle. Interlock the operating handle such that the door cannot be opened unless the switch or breaker is in the "off" position. Provide means for padlocking the operating handle in the "off" position with three 5/16 inch shackle padlocks such that when the operating handle is padlocked in the "off" position, the cover door cannot be opened and the switch or breaker cannot be closed.
 - 3. Starter: Size starters per NEMA Standards for the horsepower of the motors with which they will be used, except do not furnish starters smaller than NEMA Size 1 for motors of 5 horsepower or less. Provide coils for operation on 120 volts AC unless other requirements are indicated. Equip each starter with a minimum of two convertible auxiliary contacts in addition to the normally-open seal-in contact, unless additional requirements are indicated. Provide additional contacts as indicated.

4. Thermal Overload: One in each phase wire, externally manual reset type. Select overloads after final installed horsepower of motor is determined. Do not use ratings exceeding 100% of motor full load current adjusted for ambient temperatures.
5. Control Transformer: Provide a 480-120 volt control transformer in the starter enclosure, except where a common 120 volt control power source is indicated. Fuse and ground the secondary winding as indicated. Where indicating lights, solenoid valves or other control components are to be energized from the control transformer, increase the capacity of the control transformer proportionately for loading above the minimum requirements of the operating coil.
6. Control Devices: Provide control devices as specified, in starter enclosures when required by elementary diagrams.

B. Manufacturer: Provide products of one of the following:

1. Cutler-Hammer/Westinghouse.
2. General Electric.
3. Siemens-ITE.
4. Square D.

2.2 SINGLE PHASE MANUAL MOTOR STARTERS FRACTIONAL HORSEPOWER TYPE

- A. Single-Speed Starters for 115 Volt Motors: Per NEMA Standard ICS and consisting of a toggle-operated, or key-operated when indicated, single pole, quick-make, quick-break type starter, one thermal overload element, and pilot lights in cover when indicated all mounted in a NEMA 1 surface mounting enclosure, or with a stainless steel plate for flush mounting in an outlet box, as indicated. Provide means for padlocking the toggle operator in the "off" position. Provide a total of four keys for operation of key-operated starters.
- B. Single-Speed Starters for 230 Volt Motors: Per NEMA Standard ICS and consisting of a toggle-operated, or key-operated when indicated, two pole quick-make, quick-break type starter, one thermal overload in each phase, and pilot lights when indicated, with similar features to those specified for starters for 115 volt motors.
- C. Manufacturer: Provide one of the following:
 1. Cutler-Hammer/Westinghouse Type MS.
 2. General Electric CR101.
 3. Siemens-ITE Class SMF.
 4. Square D Class 2510.

2.3 CONTROL DEVICES

- A. Push Buttons and Selector Switches: Heavy duty, oil-tight type, with contacts rated 10 amperes continuous, 600 volts AC, with legend plate and operation as indicated.
 1. Manufacturer: Provide one of the following:
 - a. Cutler-Hammer/Westinghouse 10250T
 - b. General Electric CR104P
 - c. Siemens-ITE
 - d. Square D Class 9001, Type K

- B. Indicating Lights: Heavy duty, oil-tight type with 6 volt lamp, integral 120-6 volt transformer, push-to-test feature, color cap and legend plate as indicated.

1. Manufacturer: Provide one of the following:

- a. Cutler-Hammer/Westinghouse 10250T
- b. General Electric CR104P
- c. Siemens-ITE
- d. Square D Class 9001, Type K

- C. Control Relays: Heavy duty industrial type with convertible contacts rated 10 amperes continuous, 300 volts AC. Provide coils for operation on 120 volts AC unless other requirements are indicated. Provide number and type of contacts as indicated.

1. Manufacturer: Provide products of one of the following:

- a. Cutler-Hammer/Westinghouse
- b. General Electric
- c. Siemens-ITE
- d. Square D

- D. Timing Relays in General: Electrically-operated, pneumatically-controlled type, convertible from time-delay after de-energization to time-delay after energization, or vice-versa, in the field, with timing range adjustable from 0.2 seconds to 180 seconds, repeat accuracy of plus or minus 10%, one single pole, double throw contact rated 10 amperes continuous, 300 volts AC, and coil for operation on 120 volts AC unless other requirements are indicated.

1. Manufacturer: Provide products of one of the following:

- a. Cutler-Hammer/Westinghouse
- b. General Electric
- c. Siemens-ITE
- d. Square D

- E. Motor-Driven Timing Relays: As indicated.

- F. Enclosures: NEMA 12 factory areas and NEMA 1 in other areas unless otherwise indicated.

2.4 FUSES

- A. Fuses in General: One-time high interrupting capacity, dual element type, except where current-limiting fuses are indicated or specified. Class H fuses are not acceptable.

1. Manufacturer: Provide one of the following:

- a. Bussmann "Fusetron".
- b. Gould-Shawmut "Trionic".

- B. Current-Limiting Fuses:

1. Manufacturer: Provide one of the following:

- a. Bussmann "Low--Peak-RK1".
- b. Gould-Shawmut "Amp-Trap".

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Motors: Refer to Section 16025 "Electrical Systems" for furnishing and mounting responsibility for all electric motors. Motors 1/2 horsepower and larger are 460 volts, 3 phase, 60 hertz, and motors less than 1/2 horsepower are 115 volts, single phase, 60 hertz, unless other requirements are indicated. In all cases where the capacity or rating of equipment being furnished under this Section is based on the rating of equipment being furnished under other Sections, confirm such ratings before purchasing the equipment.
- B. Control Equipment: Install equipment at locations indicated. Install motor starters, safety switches and control devices at uniform heights in general throughout the building with operating means at convenient heights above the floor and as indicated. Do not locate the operating means for individually mounted equipment at a height greater than 66 inches above the floor unless prior approval is obtained from the Architect-Engineer.
- C. Fuses: Install fuses, of required ampere rating, in all fusible equipment installed under Division 16 Sections. Verify all fuse ratings based on actual motor horsepower provided and manufacturer's requirements for equipment protection.

END OF SECTION 26 2913

SECTION 26 5119 - LED INTERIOR LIGHTING

PART 1 - 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. Interior solid-state luminaires that use LED technology.
 - 2. Materials.
 - 3. Finishes.
 - 4. Lighting fixture supports.
- B. Related Requirements:
 - 1. Section 26 0923 "Lighting Control Devices" for automatic control of lighting, including occupancy sensors and wallbox dimmers.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.
- H. L70: Point in time where light fixture output is 70% of initial light output.
- I. MacAdam Ellipse: Color consistency of LEDs from chip to chip.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture indicated.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaires.
 - 4. Include emergency lighting units, including batteries and chargers.
 - 5. Include life, output (delivered lumens, CCT, and CRI), and energy efficiency data.

6. Photometric data, including IES file, and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project, IES LM-79 and IES LM-80.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
7. LED drivers.
8. Light Emitting Diodes (LED).

B. Shop Drawings: For nonstandard luminaires.

1. Include plans, elevations, sections and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
 2. Suspended ceiling components.
 3. Structural members to which luminaires will be attached.
 4. Initial access modules for acoustical tile, including size and locations.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of luminaire.
- E. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency or by a qualified testing agency.
- F. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be within a three-step MacAdam Ellipse centered on the black body curve to ensure color consistency among luminaires.
- E. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components, including driver/power supplies and thermal management, of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Recessed Fixtures: Comply with NEMA LE 4.
- E. Bulb shape complying with ANSI C79.1.
- F. Lamp base complying with ANSI C81.61.
- G. CRI of minimum 80. CCT of 3500 K.
- H. Rated lamp life of 50,000 hours.
- I. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- J. Internal Driver: Driver shall be individually fused with fuses accessible from outside of the fixture chassis.
- K. LED (Light Engine): Complies with IEC and FCC Standards.
 - 1. LED Color Temperature: Neutral white (4000°K).
 - 2. Minimum rated lifetime of L70 @ 50,000 hours based on IES LM-80 testing.
 - 3. Operating Temperature: -40°C to +50°C (-40°F to 122°F).
 - 4. Operating Hours: Designed for 60,000+ hours of maintenance free operation.
 - 5. Warranty: Minimum 5-year warranty. If 15% or more of light emitting diodes fail to illuminate within the 5-year warranty period the manufacturer shall replace the light fixture. 5-year no color shift warranty.
 - 6. IP66 rated.
 - 7. Tested in compliance with IES LM-79, LM-80 and TM-21.
 - 8. Minimum ETL listed.
- L. Driver: Complies with IEC and FCC standards.
 - 1. Driver: Components are fully encased in potting material for moisture resistance.
 - 2. Operating Temperature: -40°C to +50°C (-40°F to 122°F).
 - 3. Operating Hours: Designed for 60,000+ hours of maintenance free operation.
 - 4. Provides transient voltage protection in accordance with IEEE/ANSI C62.41.2 guidelines.
 - 5. Warranty: 5-year warranty.
 - 6. Minimum ETL listed.
- M. Nominal Operating Voltage: 120 V ac.
 - 1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- N. Housings:
 - 1. Extruded-aluminum housing and heat sink.
 - 2. White painted finish.

2.3 LOWBAY, LINEAR

- A. Minimum allowable efficacy of 120 lumens per watt.

2.4 RECESSED LINEAR

- A. Minimum allowable efficacy of 90 lumens per watt.
- B. Integral junction box with conduit fittings.

2.5 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers:
 - 1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 2. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Housings:
 - 1. 20 gauge steel housing and heat sink.
 - 2. White powder coat finish.
- E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI for all luminaires.

2.6 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.7 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge.

- C. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- D. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

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 the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls, and secure according to manufacturer's written instructions and approved submittal materials, unless otherwise indicated. There shall be no gaps between adjacent fixtures or between luminaires and surrounding surfaces. Lenses, reflectors and trims of luminaires shall be properly and uniformly aligned.
- C. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Provide support for luminaire without causing deflection of ceiling or wall.
 - 3. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- D. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- E. Ceiling-Grid-Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
 - 3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, dimmers and accessories, and after electrical circuitry has been energized, test units to confirm proper operation and that luminaires are switched according to the Drawings.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
 - 3. A visual inspection shall be performed to verify cleanliness and alignment of the fixtures. Misalignment and light leaks shall be corrected and rattles due to ventilation system vibration shall be eliminated.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

- A. Comply with requirements for factory commissioning specified in Section 26 0943 "Lighting Control Devices."

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 26 5119

SECTION 28 3111 – FIRE ALARM SYSTEM – ADDRESSABLE

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 work of this section.

1.2 SUMMARY

- A. This Specification provides the requirements for the installation of new fire alarm devices connected to an existing fire alarm system. The system shall include, but not be limited to: alarm initiating and indicating peripheral devices, conduit, wire and accessories required to finish a complete operational system.

1.3 STANDARDS

- A. The equipment and install shall comply with the current provisions of the following standard:
 - 1. National Electric Code, Article 760 and applicable standards of NFPA 90A including (not an inclusive list):
 - a. NFPA 72A Local Protective signaling Systems.
 - b. NFPA 72B Auxiliary Protective Signaling Systems.
 - c. NFPA 72C Remote Station Protective signaling Systems.
 - d. NFPA 72D Proprietary Protective Signaling Systems.
 - e. NFPA 72E Automatic Fire Detectors.
 - f. NFPA 72F Emergency Voice/Alarm Communication Systems.
 - g. NFPA 72G Notification Appliances for Protective Signaling Systems.
 - h. NFPA 72H Testing Procedures for Protective Signaling Systems.
 - i. NFPA 101 Life Safety Code.
 - 2. Local and State building codes.
 - 3. Local authorities having jurisdiction: ULC, CSFM, BSA, State Fire Marshal.
 - 4. Underwriters' Laboratories, Inc.
- B. The system and all components shall be listed by Underwriters' Laboratories, Inc. for use in fire protective signaling system under the following standards as applicable:
 - 1. UL 865/UOJZ, APOU Control Units for Fire Protective Signaling system.
 - 2. UL 268 Smoke Detectors for Fire Protective Signaling Systems.
 - 3. UL 268A Smoke Detectors for Duct Applications.
 - 4. UL 217 Smoke Detectors Single Station.
 - 5. UL 521 Heat Detectors for Fire Protective Signaling Systems.
 - 6. UL 1638 Visual Signaling Appliances.
 - 7. UL 38 Manually Activated Signaling Boxes.
 - 8. UL 1076 Proprietary Burglary/Grade AA.
 - 9. UL 346 Waterflow Indicators for Fire Protective Signaling Systems.
 - 10. UL 1481 Power Supplies for Fire Protective Signaling Systems.

1.4 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.
 - 1. Shop Drawings: Submit detailed point-to-point wiring diagrams and installation instructions. Shop drawings shall show color coding of connections and mounting dimensions of equipment.
 - 2. Product Data: Submit product data for each fire alarm system component specified.
- B. A complete set of shop drawings shall be submitted to the State of Michigan (SOM) Office of Fire Safety for approval in accordance with Act 144 of 1982. Shop drawings shall be approved by the SOM and all SOM comments reflected on the documents prior to submission of the shop drawings to the Engineer for approval. Shop drawings submitted to the Engineer prior to SOM approval will be returned - rejected.
- C. The Contractor shall submit complete sets of documentation within 30 calendar days after award of purchase order. Indicate the type, size, rating, style, catalog number, manufacturers' names, photos, and/or catalog data sheets for all items to ensure compliance with these Specifications. This equipment shall be subject to his approval and no equipment shall be ordered without this approval. Equipment devices are shown on the Contract Drawings, provide shop drawings as follows:
 - 1. Complete one-line riser diagram showing all equipment and the size, type and number of all conductors.
 - 2. Drawing of typically multiplexed field panel.
 - 3. Provide calculations to support the size of standby batteries submitted.
 - 4. Include programming and installation manuals.
- D. At Contract close-out deliver six (6) copies of the following to the Owner's Representative within thirty (30) days of date of system acceptance:
 - 1. Installation and programming manuals covering the installed system.
 - 2. Point-to-point diagrams of the entire system as installed. Number all conductors and show all terminations and splices.
 - 3. The application program listing for the system as installed at the time of acceptance.
 - 4. Name, address, and telephone of the authorized factory representative.

1.5 WARRANTY

- A. Warranty all materials, installation and workmanship for one (1) years from date of acceptance, unless otherwise specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Match existing National Time and Signal.

2.2 WIRE AND CABLE

- A. Wire and cable shall conform to the applicable provisions of Section 26 0519 "Low Voltage Electrical Power Conductors and Cables".

2.3 AUDIOVISUAL ALARM HORNS

- A. Audiovisual Alarm Horns shall have a high intensity flashing light and alarm horn as an integral unit. All horns shall mount on 4 x 4-inch electrical boxes. The horn assembly shall be housed in a rugged, die-cast enclosure, and the electronic light source shall be sealed in silicone and protected by a Lexan lens. The word FIRE shall appear on the lens. Light shall produce a minimum of 75 candela at the rate of one flash per

second and shall meet the requirements of the Americans with Disabilities Act (ADA). The minimum sound level shall be 95 DB at ten feet. Audiovisual alarm horns shall be semiflush mounted, except as noted. Provide single and/or dual projectors as shown.

2.4 VISUAL ALARM STROBES

- A. Visual alarm strobes shall have a high intensity flashing light as an integral unit. All strobes shall mount on 4 x 4 inch electrical boxes. The strobe assembly shall be housed in a rugged, die-cast enclosure, and the electronic light source shall be sealed in silicone and protected by Lexan lens. The word FIRE shall appear on the lens. Light shall produce a minimum of 110 candela at the rate of one flash per second and shall meet the requirements of the Americans With Disabilities Act (ADA). Visual alarm strobes shall be semi-flush mounted, except as noted. Provide single and/or dual projectors as shown.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. System shall be installed with dedicated conduits, conductors, outlet boxes, fittings, connectors and accessories necessary to ensure a complete, operable system in compliance with all applicable codes and regulations.
- B. Install all equipment at locations indicated, and secure to ceilings, walls, floors or structural members as required.
- C. Install all wiring in metal conduit systems as indicated and as specified in Section 26 0500.
- D. Provide final wiring and connections per the manufacturer's wiring diagrams. Wiring for the fire alarm system shall be in separate conduits from any other system.
- E. Outlet, pull and junction boxes shall be installed in accordance with Section 26 0500.
- F. All fire alarm system conduits and outlet boxes shall be marked and labeled.
- G. T-tapped connections will not be allowed on any supervised circuits. Connections shall be directly to and from device terminal screws. Screw terminal shall have rising plates to terminate more than one wire or each wire shall be terminated to individual screws or each wire shall terminate in a ring lug.
 - 1. Notification appliance circuits (NAC) shall be Class B.
 - 2. Communication (initiating) circuits shall be Class A.
- H. Provide as-built wiring diagrams at completion of Project.

3.2 IDENTIFICATION

- A. All junction box covers, conduit couplings and panels shall be painted red to match system manufacturer's hue.
- B. Label all control and monitor modules and detectors with point numbers and function.

3.3 FIELD QUALITY CONTROL

- A. Adjusting: After completion of system wiring, connect, test, adjust, and readjust as necessary, all equipment in terms of design function and performance.
 - 1. Provide equipment to check the calibration of instruments. Instruments not in calibration, shall be recalibrated to function as required, or shall be replaced.

2. Calibrate and adjust devices, linkages, accessories, and components for stable and accurate operation to meet the design intent and to obtain optimum performance from the equipment. Final adjustment, calibration and checking shall be performed while the system is in full operation. Cause every device to automatically function as intended to insure its proper operation.
- B. Demonstration: After calibration, adjustment, and checking have been completed and system is operational, demonstrate to the governing authorities having jurisdiction and to the Architect-Engineer the complete and correct functioning of all system components and equipment. These demonstrations shall consist of operating the controls through their normal full ranges and sequences. Simulate abnormal conditions to demonstrate proper functioning of the devices. Readjust settings to their correct design values and after sufficient time, observe ability of controls to establish the desired conditions, noting abnormal deviations. Make necessary repairs, replacements or adjustments on items which fail to perform satisfactorily and repeat tests to demonstrate compliance with the design intent.
1. When system is in specified operational condition, and when pertinent operational functions have been demonstrated, system will be accepted.

END OF SECTION 28 3111