ALL TRADES SPECIFICATIONS

FERNDALE PUBLIC SCHOOLS
PROJECT NUMBER: 171745
JANUARY 12, 2018

PROJECT

FERNDALE PUBLIC SCHOOLS

2017 SINKING FUND PROJECTS
FERNDALE HIGH SCHOOL-
KITCHEN/SERVING LINE AND
CAFETERIA RENOVATION

OWNER
Ferndale Public Schools
871 Pinecrest
Ferndale, MI 48220

ARCHITECT
Wakely Associates, Inc.
30500 Van Dyke Ave., Suite 209
Warren, Michigan 48093
SPECIFICATIONS

PROJECT NUMBER 171745  
JANUARY 12, 2018

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FERNDALE PUBLIC SCHOOLS  
2017 SINKING FUND PROJECTS  
FERNDALE HIGH SCHOOL  
KITCHEN/SERVING LINE AND  
CAFETERIA RENOVATION

OWNER  
FERNDALE WOODS PUBLIC SCHOOLS  
871 PINECREST  
FERNDALE, MI 48220

ARCHITECT  
WAKELY ASSOCIATES, INC.  
30500 VAN DYKE, SUITE 209  
WARREN, MICHIGAN 48093  
586-573-4100

MECHANICAL/ELECTRICAL ENGINEERS  
PETER BASSO ASSOCIATES  
5145 LIVERNOIS ROAD – SUITE 100  
TROY, MI 48098  
248-879-5666
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>TABLE OF CONTENTS</th>
<th>PAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title Page</td>
<td>1</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>4</td>
</tr>
</tbody>
</table>

DIVISION 0  BIDDING AND CONTRACT REQUIREMENTS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>00020 Invitation for Bids</td>
<td>3</td>
</tr>
<tr>
<td>00100 Instructions to Bidders</td>
<td>5</td>
</tr>
<tr>
<td>Non-Collusion Affidavit</td>
<td>1</td>
</tr>
<tr>
<td>Work References</td>
<td>1</td>
</tr>
<tr>
<td>00311 Proposal Form-Proposal A</td>
<td>6</td>
</tr>
<tr>
<td>00311 Proposal Form-Proposal B</td>
<td>6</td>
</tr>
<tr>
<td>00311 Proposal Form-Proposal C</td>
<td>6</td>
</tr>
<tr>
<td>00311 Proposal Form-Proposal D</td>
<td>6</td>
</tr>
<tr>
<td>00311 Proposal Form-Proposal E</td>
<td>6</td>
</tr>
<tr>
<td>00311 Proposal Form-Proposal F</td>
<td>5</td>
</tr>
<tr>
<td>00401 Familial Disclosure Form</td>
<td>1</td>
</tr>
<tr>
<td>00401A Affidavit of Compliance-Iran Economic Sanctions Act</td>
<td>1</td>
</tr>
<tr>
<td>00710 General Conditions</td>
<td>1</td>
</tr>
<tr>
<td>00810 Modifications of the General Conditions</td>
<td>8</td>
</tr>
<tr>
<td>00851 Index of Drawings</td>
<td>2</td>
</tr>
</tbody>
</table>

DIVISION 1  GENERAL REQUIREMENTS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>01010 Summary of Work-Proposal A</td>
<td>6</td>
</tr>
<tr>
<td>01010 Summary of Work-Proposal B</td>
<td>2</td>
</tr>
<tr>
<td>01010 Summary of Work-Proposal C</td>
<td>2</td>
</tr>
<tr>
<td>01010 Summary of Work-Proposal D</td>
<td>6</td>
</tr>
<tr>
<td>01010 Summary of Work-Proposal E</td>
<td>5</td>
</tr>
<tr>
<td>01010 Summary of Work-Proposal F</td>
<td>2</td>
</tr>
<tr>
<td>01041 Project Coordination</td>
<td>4</td>
</tr>
<tr>
<td>01045 Cutting and Patching</td>
<td>5</td>
</tr>
<tr>
<td>01090 Reference Standards</td>
<td>7</td>
</tr>
<tr>
<td>01100 Alternates</td>
<td>2</td>
</tr>
<tr>
<td>01200 Project Meetings</td>
<td>4</td>
</tr>
<tr>
<td>01310 Construction Schedules</td>
<td>3</td>
</tr>
<tr>
<td>01340 Shop Drawings, Product Data and Samples</td>
<td>4</td>
</tr>
<tr>
<td>01370 Schedules of Values</td>
<td>1</td>
</tr>
<tr>
<td>01400 Quality Control</td>
<td>5</td>
</tr>
<tr>
<td>01600 Material and Equipment</td>
<td>5</td>
</tr>
<tr>
<td>01700 Project Closeout</td>
<td>6</td>
</tr>
<tr>
<td>01800 Guarantee-Warranty</td>
<td>1</td>
</tr>
</tbody>
</table>

DIVISION 2  SITE

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>02070 Selective Demolition</td>
<td>6</td>
</tr>
<tr>
<td>DIVISION 3</td>
<td>CONCRETE</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>03001</td>
<td>Concrete</td>
</tr>
<tr>
<td>03300</td>
<td>Bonding Agents for Concrete</td>
</tr>
<tr>
<td>03350</td>
<td>Terrazzo Polishing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIVISION 4</th>
<th>MASONRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>04100</td>
<td>Mortar &amp; Grout</td>
</tr>
<tr>
<td>04270</td>
<td>Glass Unit Masonry</td>
</tr>
<tr>
<td>04300</td>
<td>Unit Masonry</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIVISION 5</th>
<th>METALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>05400</td>
<td>Cold-Formed Metal Framing</td>
</tr>
<tr>
<td>05500</td>
<td>Metal Fabrications</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIVISION 6</th>
<th>WOOD AND PLASTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>06100</td>
<td>Carpentry</td>
</tr>
<tr>
<td>06402</td>
<td>Interior Architectural Woodwork</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIVISION 7</th>
<th>THERMAL AND MOISTURE PROTECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>07200</td>
<td>Insulation</td>
</tr>
<tr>
<td>07840</td>
<td>Firestopping</td>
</tr>
<tr>
<td>07910</td>
<td>Joint Fillers and Gaskets</td>
</tr>
<tr>
<td>07920</td>
<td>Sealants and Caulking</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIVISION 8</th>
<th>DOORS AND WINDOWS</th>
</tr>
</thead>
<tbody>
<tr>
<td>08112</td>
<td>Hollow Metal Work</td>
</tr>
<tr>
<td>08210</td>
<td>Wood Doors</td>
</tr>
<tr>
<td>08710</td>
<td>Finish Hardware</td>
</tr>
<tr>
<td>08800</td>
<td>Glass &amp; Glazing</td>
</tr>
<tr>
<td>08810</td>
<td>Fire Rated Glass</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIVISION 9</th>
<th>FINISHES</th>
</tr>
</thead>
<tbody>
<tr>
<td>09250</td>
<td>Gypsum Drywall</td>
</tr>
<tr>
<td>09300</td>
<td>Tile Work</td>
</tr>
<tr>
<td>09510</td>
<td>Acoustical Ceilings</td>
</tr>
<tr>
<td>09650</td>
<td>Resilient Flooring</td>
</tr>
<tr>
<td>09900</td>
<td>Painting</td>
</tr>
</tbody>
</table>
DIVISION 10  SPECIALTIES

10400  Identification Devices  5
10999  Miscellaneous Specialties  3

DIVISION 11  EQUIPMENT

11400  Food Service Equipment  67

DIVISION 12  FURNISHING AND SEATING

12300  Plastic Laminate Casework  14

DIVISION 15  MECHANICAL

15010  Mechanical General Requirements  16
15050  Basic Mech. Materials and Methods  30
15053  Common Work Results for HVAC  8
15055  Motors  12
15060  Hangers and Supports  21
15075  Mechanical Identification  13
15080  Mechanical Insulation  40
15110  General Duty Valves for Plumbing  13
15112  General Duty Valves for HVAC  14
15122  Meters and Gages  7
15140  Domestic Water Piping  12
15145  Domestic Water Piping Specialties  13
15150  Sanitary Waste and Vent Piping  13
15155  Drainage Piping Specialties  11
15181  Hydronic Piping  21
15188  Piping Systems Flushing and Chemical Cleaning  8
15189  HVAC Water Treatment  11
15194  Fuel Gas Piping  13
15441  Domestic Water Circulation Pumps  6
15485  Electric Domestic Water Heaters  7
15761  Heating and Cooling Coils  4
15815  Metal Ducts  21
15820  Duct Accessories  12
15855  Diffusers, Registers & Grilles  4
15950  Testing, Adjusting & Balancing  25
## DIVISION 16  ELECTRICAL

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>16010</td>
<td>Electrical General Requirements</td>
<td>17</td>
</tr>
<tr>
<td>16060</td>
<td>Grounding and Bonding</td>
<td>8</td>
</tr>
<tr>
<td>16073</td>
<td>Hangers and Supports</td>
<td>11</td>
</tr>
<tr>
<td>16075</td>
<td>Electrical Identification</td>
<td>9</td>
</tr>
<tr>
<td>16120</td>
<td>Conductors and Cables</td>
<td>7</td>
</tr>
<tr>
<td>16130</td>
<td>Raceways and Boxes</td>
<td>13</td>
</tr>
<tr>
<td>16140</td>
<td>Wiring Devices</td>
<td>11</td>
</tr>
<tr>
<td>16145</td>
<td>Lighting Control Devices</td>
<td>11</td>
</tr>
<tr>
<td>16442</td>
<td>Panelboards</td>
<td>12</td>
</tr>
<tr>
<td>16461</td>
<td>Dry-Type Transformers</td>
<td>11</td>
</tr>
<tr>
<td>16511</td>
<td>Interior Lighting</td>
<td>15</td>
</tr>
<tr>
<td>16570</td>
<td>Dimming Controls</td>
<td>8</td>
</tr>
<tr>
<td>16721</td>
<td>Fire Alarm</td>
<td>18</td>
</tr>
<tr>
<td>16723</td>
<td>School Intercom and Program Equip.</td>
<td>8</td>
</tr>
</tbody>
</table>
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

SECTION 00020 - ADVERTISEMENT FOR BIDS

Ferndale Public Schools (FPS) will receive bids for:

Ferndale Public Schools
2017 Sinking Fund Project
Ferndale High School
Kitchen/Serving Line and
Cafeteria Renovation

TYPE OF PROPOSAL:
A single lump sum proposal is being entertained for the work for each project.

DATE OF SUBMISSION:
Bidders shall submit an original and two copies of their bid to the attention of the Assistant Superintendent of Business Services, Nancy Hoover, at Ferndale Public Schools Central Offices (located inside the high school on the 3rd floor), Room 326, 871 Pinecrest, Ferndale, MI 48022, no later than 3:00pm on Wednesday, February 14, 2018. At 3:15 pm, the same day, the bids will be publicly open and read aloud each bid submitted. The location of the public reading will be the front office conference room in the high school. Late bids will not be considered or accepted.

The bid shall be accompanied by a sworn and notarized statement disclosing any familial relationship that exists between the Owner or any employee of the bidder and any member of the School Board, or the Superintendent of Schools. The Owner will not accept a bid that does not include this sworn and notarized disclosure statement.

PROPOSAL GUARANTY:
Each proposal must be accompanied by a certified check, cashier’s check, or a satisfactory Surety Bid Bond in an amount not less than five percent (5%) of the total bid price as guaranty. No bid shall be considered unless it is accompanied by the required guaranty.

Checks shall be made payable to Ferndale Public Schools.
Such cash, checks, or bid bonds will be returned to all except the three lowest bidders for each contract within five (5) days after the opening of bids, and the remaining cash, checks, or bid bonds will be returned promptly after the Owner and the accepted bidders have executed the Contract, or if no award has been made, within sixty (60) days after the date of the opening of bids, upon demand of the bidder at any time thereafter, so long as he has not been notified of the acceptance of his bid.

PRE-BID MEETING

The School District will hold a pre-bid walkthrough on Wednesday January 31, 2018 at 3:30pm at Ferndale High School, 871 Pinecrest, Ferndale, MI 48022.

Attendance at this pre-bid meeting is not mandatory, however, absolutely no extra cost will be allowed for any item or thing which could have been seen by visiting the site.

The School District will schedule site visits upon request. Bidders should contact the Director of Operations, Jamie Stottlemyer at 248-701-4630, or email james.stottlemyer@ferndaleschools.org to arrange for site visits.

BIDDING DOCUMENTS:

Bidding documents consist of plans and specifications as prepared by Wakely Associates Inc./Architects, Warren, Michigan.

Bid documents can be obtained at the offices of ARC, 1009 W. Maple Road, Clawson, MI 48017 beginning January 15, 2018.

Bidding documents will be available on or after January 15, 2018 by calling Wakely Associates Inc. at 586-573-4100 or email at aduda@wakelyaia.com for a link to access the documents.

Copies of the Bidding documents will also be on file for reference at the office of:

1. The Owner
2. CAM, Bloomfield Hills
3. McGraw Hill, Detroit
4. Reed Construction Data, Novi
5. The Architect
PROPOSAL ACCEPTANCE:

The right to accept and/or reject any and all proposals and to waive any and all informalities and/or irregularities in bid proposals submitted during the bidding process is reserved by the Owner, which right may be exercised at the sole discretion of the Owner.

PROPOSAL WITHDRAWAL:

Proposals for base bids may not be withdrawn for a period of sixty (60) days after the time established for the receipt of proposals. Bidders may withdraw at any item prior to the time set for the receipt of proposals.

All bids must be submitted on forms included in this proposal. All bids must be accompanied by a sworn and notarized statement disclosing any familial relationship that exists between the Owner (bidder) or any employee of the bidder and any member of the FPS School Board, Administration or Staff. Bids received without a sworn and notarized statement of disclosure WILL BE GROUNDS FOR REJECTION.

Ferndale Public Schools reserves the right to reject any or all bids, in whole or in part, to waive any irregularities therein and accept that bid, which best serves Ferndale Public Schools interest.
SECTION 00100 - INSTRUCTIONS TO BIDDERS

Owner will receive sealed proposals only as set forth in the Invitation to Bid and complying with all requirements as contained in Instructions to Bidders.

DOCUMENTS

Bidding documents consist of plans and specifications as prepared by Wakely Associates Inc./Architects, Warren, Michigan.

Bid documents can be obtained at the offices of ARC, 1009 W. Maple Road, Clawson, MI 48107 beginning January 15, 2018.

Bidding documents will be available on or after January 15, 2018 by calling Wakely Associates Inc. at 586-573-4100 or email at aduda@wakelyaia.com for a link to access the documents.

Copies of the Bidding documents will also be on file for reference at the office of:

1. The Owner
2. CAM, Bloomfield Hills
3. McGraw Hill, Detroit
4. Reed Construction Data, Novi
5. The Architect

BIDDING DOCUMENTS

The Bidding Documents consist of the following:

- The Drawings as enumerated in Section 00851, Index of Drawings.
- The Specifications as enumerated in the Table of Contents.
- All other documents as provided for in Article 1, Paragraph 1, Section 1 of the General Conditions as modified.

EXAMINATION

Each bidder shall examine the Bidding Documents and satisfy himself about the extent of the proposed work by personal examinations of the site and surroundings, and make his own estimate therefrom of the facilities and difficulties attending the performance and completion of the job.

No additional compensation will be allowed on account of conditions which could be determined by examining the Bidding Documents or the site.
INTERPRETATION

If any person contemplating submitting a bid is in doubt as to the true meaning of any part of the Drawings, Specifications, or other Bidding Documents, he must submit to the Architect a written request for an interpretation thereof. If such an interpretation is not requested, the bids will be presumed to be based upon the interpretation and directions given by the Architect after Contract award, in accordance with provisions of the Contract.

Neither the Owner nor the Architect will be responsible for any verbal explanations or interpretations of the Bidding Documents.

Every request for such interpretation should be in writing, addressed to the Architect at his office, and to be given consideration, must be received at least ten (10) days prior to the date fixed for the opening of bids. Any and all such interpretations, and any supplemental instructions will be in the form of written addenda to the Bidding Documents which, if issued, will be mailed to all prospective bidders (at the respective address furnished for such purposes) prior to the date fixed for the opening of bids. All addenda so issued shall become part of the Bidding Documents.

SUBSTITUTIONS

To obtain approval to use unspecified products, bidders shall submit written requests at least five (5) days before the bid date. Requests received after this time will not be considered. Requests shall clearly describe the product for which approval is asked, including all data necessary to demonstrate acceptability. If the product is acceptable, the Architect will approve it in an Addendum issued to all prime bidders on record.

BASIS OF BID

A single lump sum proposal is being entertained for the complete work identified for each project.

Partial or segregated bids or assignments will not be considered. Include quotes for all alternates and unit prices; failure to do so may result in rejection of the proposal.
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

PREPARATION

Proposal shall be submitted on the form bound in these specifications, Form of Proposal, in original form without erasures, interlineations or alterations.

Submit two (2) copies of proposal, retain one for your records. Oral, fax, email, or telephone proposals will not be accepted.

Proposals must be filled out in ink or typewritten in duplicate. Blank spaces in the proposals must be filled in and no changes shall be made to the phraseology of the proposal. Quotes shall be entered in verbal and numeric forms. In case of a discrepancy between the written and the numeric form, the written form shall govern.

All bids shall be signed and dated in longhand.

Bids which are not signed by the individual making them should have attached thereto a power of attorney, evidencing authority to act as agent for the person whom it is signed.

Bids which are signed for a partnership should be signed by one of the partners or by an attorney-in-fact. If signed by an attorney-in-fact, evidence of authority to sign the bids shall be attached.

Bids which are signed for a corporation should have the correct corporate name thereon and the signature of the president or other officer legally able to contract in the name of the corporations. In addition, a signed Secretary's Certificate evidencing the authority of the Officer to contract in the name of the corporation shall be included. Any proposal submitted by a corporation shall bear its seal.

BID SECURITY

The successful bidders securities will be retained until they have signed the Contract and furnished the required payment and performance bonds. The Owner reserves the right to retain the security of the next two lowest bidders for each contract until the lowest bidders enter into contract, or until sixty (60) days after the bid opening, whichever is the shorter. All other bid security will be returned as soon as practicable. If any bidder refuses to enter into a Contract, the Owner will retain his Bid Security as liquidated damages, but not as a penalty.
SUBCONTRACTORS

The Owner and Architect reserve the right to require of bidders tentatively selected for consideration in the awarding of the Contract, a list of the subcontractors whom the Contractor intends to employ.

The Owner reserves the right to disapprove the use of any proposed subcontractor, and in such event, the bidder submitting such subcontractor shall submit another such subcontractor in like manner within the time specified by the Owner. The Owner reserves the right to reject any bid if such information required by the Owner is not submitted as above indicated.

SUBMITTAL

Submit proposals in sealed opaque envelopes having listed thereon the following:

PROPOSAL: FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HIGH SCHOOL
KITCHEN/SERVING LINE
AND CAFETERIA RENOVATIONS
ATTN: NANCY HOOVER, BUSINESS MANAGER

Contractor: ____________________________

WITHDRAWAL

Proposals for base bids may not be withdrawn for a period of sixty (60) days after the time established for the receiving of proposals. Bidders may withdraw at any time prior to the time set for the receiving of proposals.

IRREGULARITIES

The Owner reserves the right to disqualify Bids before or after opening, upon evidence of collusion with intent to defraud, or other illegal practices upon the part of the bidder.

The Owner also reserves the right to reject any or all bids in whole or in part and to waive any informalities therein.

Any error and/or omission in the proposal form or any other irregularity as a result of negligent preparation shall not furnish cause for relief for any damages resulting therefrom, nor in any way relieve the Contractor from fulfillment of all contractual obligations as provided for in the Bidding Documents.
TAXES AND CONTRIBUTIONS

Proposal, unit prices, alternate prices stated include all taxes or contributions required by bidders business.

Michigan State sales tax is applicable to this work.

OPENING

Proposals will be publicly opened and read aloud.

BID BREAKDOWN CONSTRUCTION INFORMATION

Upon notice from the Architect, the low bidders shall submit a detailed cost breakdown of all work covered by the Bidding Documents. The breakdown shall show quantity of material and labor, units of material and labor, material cost, labor cost and total cost.

AWARD OF CONTRACT

The Contract will be awarded to the lowest responsible bids, complying with the terms of the Bidding Documents, with full consideration of alternates.

EXECUTION OF CONTRACT

The Owner reserves the right to accept any and all bids, or to negotiate contract terms with the various bidders when such is deemed by the Owner to be in his best interest.

END OF SECTION 00100
NON-COLLUSION AFFIDAVIT

County )
 ) SS:
__________________________________________________ being first duly sworn,
deposes and says that he is the

________________________________________
(Individual, Partner, Corporate Officer)

making the foregoing proposals or bids; that such bids are genuine and not collusive or
sham; such bidder has not colluded, conspired, connived, or agreed, directly or indirectly,
with any bidder or person, to put in sham a bid, or that such other person shall refrain from
bidding and has not in any manner, directly with any person, to fix the bid price of afferent
or any other bidder, or to fix any overhead, profit or cost element of said bid price, or of that
of any other bidder, or to secure any advantage against the Joint Purchasers or any person
or persons proposal are true; and further, that such bidder has not, directly or indirectly
submitted this bid, or the contents thereof, or divulged information or data relative thereto
any association or to any member or to any member or agent thereof.

________________________________________

Sworn to and subscribed before me this _________ day of ___________, 20_____.

________________________________________
Notary Public

My commission expires on __________________________________

BIDDER: THIS AFFIDAVIT MUST BE COMPLETED, SIGNED, NOTARIZED AND
INCLUDED IN YOUR BID SUBMISSION.
WORK REFERENCES

Please list at least three (3) companies or public agencies for which you have done similar work. Macomb County reserves the right to reject low bids for poor past performance or inadequate references.

<table>
<thead>
<tr>
<th>NAME OF COMPANY</th>
<th>CONTACT PERSON</th>
<th>ADDRESS</th>
<th>TELEPHONE NO.</th>
</tr>
</thead>
<tbody>
<tr>
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Ferndale High School
2017 Sinking Fund Projects
Ferndale HS - Kitchen/Serving Line
and Cafeteria Renovation

Owner:
Ferndale Public Schools
871 Pinecrest
Ferndale, Michigan 48220

Architect:
Wakely Associates, Inc.
30500 Van Dyke Avenue - Suite 209
Warren, MI 48093

Base Proposal - Proposal A: General Trades

Pursuant to and in compliance with the Invitation to Bid and the Instructions to Bidders, and having carefully examined the Bidding Documents and all Addenda, the undersigned agrees to enter into an agreement with the Owner to complete the work in accordance with the said Bidding Documents for the sum of:

(Sum to be written out)

Dollars $_________________________

Cost of bond (if bid is less than $50,000: if bid is $50,000 or
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

higher, bond cost is to be included in base bid)
_____________________________________Dollars $___________________

ALTERNATES

The undersigned further proposes to execute the work specified in
the respective technical division or indicated on the drawings for
the sum added to the base proposal as stated below:

Alternate No. 1: Provide cost to perform all work associated with
constructing new walls, reconfiguring gas, electrical and plumbing
lines, adding food service equipment and all related items in the
Kitchen Area 18 as indicated on the drawings.

ADD/DEDUCT/NO CHANGE:__________________________________________
____________________________________Dollars $__________________

UNIT PRICES

Unit Prices shall include all charges applicable to the
items including, but not limited to, materials, shoring,
hauling removal, fee, layout, supervision and overhead (field
and home office), labor, general expenses, transportation,
taxes, insurance and profit. Single unit prices shall apply
to additions to, or deductions from the Work.

In submitting this bid, the Bidder agrees that Work Item
quantities are estimates and that the Owner may increase
or decrease these quantities at the unit prices stated. Each
bidder shall show below the amounts proposed to be added to or
deducted from the Base Bid Total upon adjustment of the
quantity given for the actual measurement of individual items
of the Work. Reimbursement of the Contractor will be made
strictly on the basis of a quantitative survey of extended
material placed for the unit prices shown.

Unit Price No. 1: ($ per square foot)
Additional painting of wall or ceiling surfaces inclusive of
all necessary preparation required.
$_____________________________per square foot

ALLOWANCES
The undersigned acknowledges that he has included the allowance identified within this bid category inside the base bid amount for this category for use as a construction contingency at the Owner’s discretion. Any unused amount will be credited back to the Owner via change order at the completion of the project.

VOLUNTARY ALTERNATES

The following voluntary alternates are offered by the bidder. The undersigned agrees that the amounts indicated below shall be added to or deducted from the Base Bid, as the case may be, for each alternate which is accepted.

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PRICE GUARANTEE

The undersigned proposes that the price stated in this Proposal is guaranteed for sixty (60) consecutive days from bid date.

TAXES

The undersigned acknowledges that the price stated above includes all taxes of whatever character or description.

SUPPLEMENTAL FEES

For additional work performed upon instruction of the Owner by subcontractors of the undersigned, add to the subcontractor’s prices for such additional work a fee of ______% which includes all the charges of the undersigned for overhead and profit.
persons other than the subcontractors of the undersigned, the charges will be actual cost of all labor and materials (less all discounts) plus the fee of ______% which includes all the charges of the undersigned for overhead and profit and to which shall be added the actual cost of insurance and taxes. Each proposal covering extra work shall be accompanied with complete itemized material and labor breakdowns.

For all revisions involving the deletion of contract work, it is agreed that full credit shall be given the Owner for such work deleted, including overhead and profit as quoted hereinbefore.

TIME OF COMPLETION

The undersigned agrees to commence work operations immediately upon award of contract. Date of substantial completion will be determined with the lowest successful bidder.

ADDENDA

If any addenda or bulletins covering changes to the Bidding Documents have been received during the bidding period, the bidder shall fill in their numbers and dates which acknowledges having received same, and having included in this Proposal the work involved:

________________________________________Dated____________________

________________________________________Dated____________________

________________________________________Dated____________________

BID SECURITY

A bid bond executed by a U.S. Treasury Listed Surety Company acceptable to Ferndale Public Schools or a cashier’s check in the amount of at least 5% of the sum of the proposal payable to Ferndale Public Schools shall be submitted with each proposal in excess of $23,417. All proposals shall be firm for a period of sixty (60) days.
Successful bidders whose proposals are $50,000 or more will be required to furnish a U.S. Treasury Listed Company Performance and Payment Bond in the amount of 100% of their bid. The cost of the Bond shall be included in each proposal.

Bidders are to indicate cost of bond on the Bid Form if total bid is less than $50,000. Owner will make a decision if bond is required on all bids less than $50,000.

The Board of Education reserves the right to reject any and/or all bids in whole or in part and to waive any informality therein. The Board of Education reserves the right to accept that bid which in its opinion, is in the best interest of the Owner.

FAMILIAL DISCLOSURE

Bidder has included Section 00401 Familial Disclosure Form (bid will not be read without this form)

NEGOTIATION

The undersigned agrees that, should the overall cost exceed the funds available, he will be willing to negotiate with the Owner and Architect for the purpose of making further reductions in the Contract work, and shall agree to give full credit for all such reductions in the work requested by the Owner, including full value of labor, materials, and subcontract work and reasonable proportionate reductions in overhead and profit, thereby arriving at an agreed upon Contract price.
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

The undersigned agrees to execute a Contract for work covered by this Proposal, provided that he be notified of its acceptance within sixty (60) days after the opening of bids.

The undersigned hereby declares that he has the legal status checked below:

(  ) Individual

(  ) Partnership having the following partners:

____________________________________________
____________________________________________
____________________________________________

(  ) Corporation incorporated under the State laws of:

____________________________________________

This proposal is submitted in the name of, and notice of acceptance should be mailed, faxed, or delivered to:

Date:                        Firm's Name:

__________________________   ____________________________________
Name:                        Phone No.(   )

__________________________   By:

_______________________________
(Signature)

In the presence of:          Title:

__________________________   ____________________________________

END OF SECTION 00311
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

SECTION 00311 - PROPOSAL FORM - PROPOSAL B

___________________________________
Name of Contractor

___________________________________
Address, City, Zip

___________________________________
Phone # / Fax #

___________________________________
Email Address

PROJECT

FERNDALE PUBLIC SCHOOLS
FERNDALE HIGH SCHOOL
2017 SINKING FUND PROJECTS
Ferndale HS - Kitchen/Serving Line
and Cafeteria Renovation

OWNER

FERNDALE PUBLIC SCHOOLS
871 PINECREST
FERNDALE, MICHIGAN 48220

ARCHITECT

WAKELY ASSOCIATES, INC.
30500 VAN DYKE AVENUE - SUITE 209
WARREN, MI  48093

BASE PROPOSAL - PROPOSAL B: HARD TILE

Pursuant to and in compliance with the Invitation to Bid and the Instructions to Bidders, and having carefully examined the Bidding Documents and all Addenda, the undersigned agrees to enter into an agreement with the Owner to complete the work in accordance with the said Bidding Documents for the sum of:

_________________________________________________________________
(Sum to be written out)

_____________________________________Dollars $___________________
UNIT PRICES

Unit Prices shall include all charges applicable to the items including, but not limited to, materials, shoring, hauling removal, fee, layout, supervision and overhead (field and home office), labor, general expenses, transportation, taxes, insurance and profit. Single unit prices shall apply to additions to, or deductions from the Work.

In submitting this bid, the Bidder agrees that Work Item quantities are estimates and that the Owner may increase or decrease these quantities at the unit prices stated. Each bidder shall show below the amounts proposed to be added to or deducted from the Base Bid Total upon adjustment of the quantity given for the actual measurement of individual items of the Work. Reimbursement of the Contractor will be made strictly on the basis of a quantitative survey of extended material placed for the unit prices shown.

**Unit Price No. 1: ($ per square foot)**
Additional wall tile inclusive of all necessary preparation required.
$____________________per square foot

ALLOWANCES

The undersigned acknowledges that he has included the allowance identified within this bid category inside the base bid amount for this category for use as a construction contingency at the Owner’s discretion. Any unused amount will be credit back to the Owner via change order at the completion of the project.
VOLUNTARY ALTERNATES

The following voluntary alternates are offered by the bidder. The undersigned agrees that the amounts indicated below shall be added to or deducted from the Base Bid, as the case may be, for each alternate which is accepted.

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PRICE GUARANTEE

The undersigned proposes that the price stated in this Proposal is guaranteed for sixty (60) consecutive days from bid date.

TAXES

The undersigned acknowledges that the price stated above includes all taxes of whatever character or description.

SUPPLEMENTAL FEES

For additional work performed upon instruction of the Owner by subcontractors of the undersigned, add to the subcontractor's prices for such additional work a fee of ________% which includes all the charges of the undersigned for overhead and profit.

Any additional work performed upon instructions of the Owner by persons other than the subcontractors of the undersigned, the charges will be actual cost of all labor and materials (less all discounts) plus the fee of ________% which includes all the charges of the undersigned for overhead and profit and to which shall be added the actual cost of insurance and taxes.
Each proposal covering extra work shall be accompanied with complete itemized material and labor breakdowns.

For all revisions involving the deletion of contract work, it is agreed that full credit shall be given the Owner for such work deleted, including overhead and profit as quoted hereinbefore.

TIME OF COMPLETION
The undersigned agrees to commence work operations immediately upon award of contract. Date of substantial completion will be determined with the lowest successful bidder.

ADDENDA
If any addenda or bulletins covering changes to the Bidding Documents have been received during the bidding period, the bidder shall fill in their numbers and dates which acknowledges having received same, and having included in this Proposal the work involved:

________________________________________Dated____________________

________________________________________Dated____________________

________________________________________Dated____________________

BID SECURITY
A bid bond executed by a U.S. Treasury Listed Surety Company acceptable to Ferndale Public Schools or a cashier’s check in the amount of at least 5% of the sum of the proposal payable to Ferndale Public Schools shall be submitted with each proposal in excess of $23,417. All proposals shall be firm for a period of sixty (60) days.
PERFORMANCE AND LABOR BOND

Successful bidders whose proposals are $50,000 or more will be required to furnish a U.S. Treasury Listed Company Performance and Payment Bond in the amount of 100% of their bid. The cost of the Bond shall be included in each proposal.

Bidders are to indicate cost of bond on the Bid Form if total bid is less than $50,000. Owner will make a decision if bond is required on all bids less than $50,000.

The Board of Education reserves the right to reject any and/or all bids in whole or in part and to waive any informality therein. The Board of Education reserves the right to accept that bid which in its opinion, is in the best interest of the Owner.

FAMILIAR DISCLOSURE

Bidder has included Section 00401 Familial Disclosure Form (bid will not be read without this form)

NEGOTIATION

The undersigned agrees that, should the overall cost exceed the funds available, he will be willing to negotiate with the Owner and Architect for the purpose of making further reductions in the Contract work, and shall agree to give full credit for all such reductions in the work requested by the Owner, including full value of labor, materials, and subcontract work and reasonable proportionate reductions in overhead and profit, thereby arriving at an agreed upon Contract price.
CONTRACT EXECUTION

The undersigned agrees to execute a Contract for work covered by this Proposal, provided that he be notified of its acceptance within sixty (60) days after the opening of bids.

The undersigned hereby declares that he has the legal status checked below:

(  ) Individual

(  ) Partnership having the following partners:

____________________________________________
____________________________________________
____________________________________________

(  ) Corporation incorporated under the State laws of:

____________________________________________

This proposal is submitted in the name of, and notice of acceptance should be mailed, faxed, or delivered to:

Date:                        Firm's Name:

____________________________________________

Name:                        Phone No. (  )

____________________________________________

By:                          (Signature)

In the presence of:          Title:

____________________________________________

END OF SECTION 00311
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

SECTION 00311 - PROPOSAL FORM - PROPOSAL C

___________________________________
Name of Contractor

___________________________________
Address, City, Zip

___________________________________
Phone # / Fax #

___________________________________
Email Address

PROJECT

FERNDALE PUBLIC SCHOOLS
FERNDALE HIGH SCHOOL
2017 SINKING FUND PROJECTS
Ferndale HS - Kitchen/Serving Line
and Cafeteria Renovation

OWNER

FERNDALE PUBLIC SCHOOLS
871 PINECREST
FERNDALE, MICHIGAN 48220

ARCHITECT

WAKELY ASSOCIATES, INC.
30500 VAN DYKE AVENUE - SUITE 209
WARREN, MI  48093

BASE PROPOSAL - PROPOSAL C: TERRAZZO POLISHING

Pursuant to and in compliance with the Invitation to Bid and the Instructions to Bidders, and having carefully examined the Bidding Documents and all Addenda, the undersigned agrees to enter into an agreement with the Owner to complete the work in accordance with the said Bidding Documents for the sum of:

_________________________________________________________________
(Sum to be written out)

Dollars $___________________

Cost of bond (if bid is less than $50,000: if bid is $50,000 or
FERNDALE PUBLIC SCHOOLS  
2017 SINKING FUND PROJECTS 
FERNDALE HS-KITCHEN/SERVING LINE 
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018 

higher, bond cost is to be included in bid) 

______________________________________ Dollars $___________________

ALTERNATES

The undersigned further proposes to execute the work specified in 
the respective technical division or indicated on the drawings for 
the sum added to the base proposal as stated below:

Alternate No. 2: Provide cost to grind and polish all terrazzo 
floors in the Cafeteria 01, Serving 09, Corridor 17 and Kitchen 
Area 18 as indicated on the drawings.

ADD/DEDUCT/NO CHANGE:__________________________________________

____________________________________Dollars $__________________

UNIT PRICES

Unit Prices shall include all charges applicable to the 
items including, but not limited to, materials, shoring, 
hauling removal, fee, layout, supervision and overhead (field 
and home office), labor, general expenses, transportation, 
taxes, insurance and profit. Single unit prices shall apply 
to additions to, or deductions from the Work.

In submitting this bid, the Bidder agrees that Work Item 
quantities are estimates and that the Owner may increase 
or decrease these quantities at the unit prices stated. Each 
bidder shall show below the amounts proposed to be added to or 
deducted from the Base Bid Total upon adjustment of the 
quantity given for the actual measurement of individual items 
of the Work. Reimbursement of the Contractor will be made 
strictly on the basis of a quantitative survey of extended 
material placed for the unit prices shown.

Unit Price No. 1: ($ per lineal foot) 
Additional crack fill and repair of terrazzo floor surfaces 
inclusive of all necessary preparation required. 
$_______________________________per lineal foot
VOLUNTARY ALTERNATES

The following voluntary alternates are offered by the bidder. The undersigned agrees that the amounts indicated below shall be added to or deducted from the Base Bid, as the case may be, for each alternate which is accepted.

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PRICE GUARANTEE

The undersigned proposes that the price stated in this Proposal is guaranteed for sixty (60) consecutive days from bid date.

TAXES

The undersigned acknowledges that the price stated above includes all taxes of whatever character or description.

SUPPLEMENTAL FEES

For additional work performed upon instruction of the Owner by subcontractors of the undersigned, add to the subcontractor's prices for such additional work a fee of _______% which includes all the charges of the undersigned for overhead and profit.

Any additional work performed upon instructions of the Owner by persons other than the subcontractors of the undersigned, the charges will be actual cost of all labor and materials (less all discounts) plus the fee of _______% which includes all the charges of the undersigned for overhead and profit and to which shall be added the actual cost of insurance and taxes.
Each proposal covering extra work shall be accompanied with complete itemized material and labor breakdowns.

For all revisions involving the deletion of contract work, it is agreed that full credit shall be given the Owner for such work deleted, including overhead and profit as quoted hereinbefore.

TIME OF COMPLETION

The undersigned agrees to commence work operations immediately upon award of contract. Date of substantial completion will be determined with the lowest successful bidder.

ADDENDA

If any addenda or bulletins covering changes to the Bidding Documents have been received during the bidding period, the bidder shall fill in their numbers and dates which acknowledges having received same, and having included in this Proposal the work involved:

________________________________________ Dated ______________________

________________________________________ Dated ______________________

________________________________________ Dated ______________________

BID SECURITY

A bid bond executed by a U.S. Treasury Listed Surety Company acceptable to Ferndale Public Schools or a cashier’s check in the amount of at least 5% of the sum of the proposal payable to Ferndale Public Schools shall be submitted with each proposal in excess of $23,417. All proposals shall be firm for a period of sixty (60) days.
PERFORMANCE AND LABOR BOND

Successful bidders whose proposals are $50,000 or more will be required to furnish a U.S. Treasury Listed Company Performance and Payment Bond in the amount of 100% of their bid. The cost of the Bond shall be included in each proposal.

Bidders are to indicate cost of bond on the Bid Form if total bid is less than $50,000. Owner will make a decision if bond is required on all bids less than $50,000.

The Board of Education reserves the right to reject any and/or all bids in whole or in part and to waive any informality therein. The Board of Education reserves the right to accept that bid which in its opinion, is in the best interest of the Owner.

FAMILIAL DISCLOSURE

Bidder has included Section 00401 Familial Disclosure Form (bid will not be read without this form)

NEGOTIATION

The undersigned agrees that, should the overall cost exceed the funds available, he will be willing to negotiate with the Owner and Architect for the purpose of making further reductions in the Contract work, and shall agree to give full credit for all such reductions in the work requested by the Owner, including full value of labor, materials, and subcontract work and reasonable proportionate reductions in overhead and profit, thereby arriving at an agreed upon Contract price.
CONTRACT EXECUTION

The undersigned agrees to execute a Contract for work covered by this Proposal, provided that he be notified of its acceptance within sixty (60) days after the opening of bids.

The undersigned hereby declares that he has the legal status checked below:

(  ) Individual

(  ) Partnership having the following partners:

____________________________________________
____________________________________________
____________________________________________

(  ) Corporation incorporated under the State laws of:

____________________________________________

This proposal is submitted in the name of, and notice of acceptance should be mailed, faxed, or delivered to:

Date:                        Firm's Name:
__________________________   ____________________________________

Name:                        Phone No. ( )
__________________________   By:
____________________________________________

In the presence of:           Title:
__________________________   ____________________________________

END OF SECTION 00311
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

SECTION 00311 - PROPOSAL FORM - PROPOSAL D

___________________________________
Name of Contractor

___________________________________
Address, City, Zip

___________________________________
Phone # / Fax #

___________________________________
Email Address

PROJECT

FERNDALE PUBLIC SCHOOLS
FERNDALE HIGH SCHOOL
2017 SINKING FUND PROJECTS
Ferndale HS - Kitchen/Serving Line
and Cafeteria Renovation

OWNER

FERNDALE PUBLIC SCHOOLS
871 PINECREST
FERNDALE, MICHIGAN 48220

ARCHITECT

WAKELY ASSOCIATES, INC.
30500 VAN DYKE AVENUE - SUITE 209
WARREN, MI 48093

BASE PROPOSAL - PROPOSAL D: PLUMBING/Mechanical

Pursuant to and in compliance with the Invitation to Bid and the Instructions to Bidders, and having carefully examined the Bidding Documents and all Addenda, the undersigned agrees to enter into an agreement with the Owner to complete the work in accordance with the said Bidding Documents for the sum of:

_________________________________________________________________
(Sum to be written out)

_____________________________________Dollars $___________________
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

Cost of bond (if bid is less than $50,000: if bid is $50,000 or higher, bond cost is to be included in bid)

_____________________________________Dollars $___________________

ALTERNATES

The undersigned further proposes to execute the work specified in the respective technical division or indicated on the drawings for the sum added to the base proposal as stated below:

Alternate No. 1: Provide cost to perform all work associated with constructing new walls, reconfiguring gas, electrical and plumbing lines, adding food service equipment and all related items in the Kitchen Area 18 as indicated on the drawings.

ADD/DEDUCT/NO CHANGE: ____________________________________________

_____________________________________Dollars $__________________

ALLOWANCES

The undersigned acknowledges that he has included the allowance identified within this bid category inside the base bid amount for this category for use as a construction contingency at the Owner’s discretion. Any unused amount will be credit back to the Owner via change order at the completion of the project.

VOLUNTARY ALTERNATES

The following voluntary alternates are offered by the bidder. The undersigned agrees that the amounts indicated below shall be added to or deducted from the Base Bid, as the case may be, for each alternate which is accepted.

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PRICE GUARANTEE

The undersigned proposes that the price stated in this Proposal is guaranteed for sixty (60) consecutive days from bid date.

TAXES

The undersigned acknowledges that the price stated above includes all taxes of whatever character or description.

SUPPLEMENTAL FEES

For additional work performed upon instruction of the Owner by subcontractors of the undersigned, add to the subcontractor's prices for such additional work a fee of _______% which includes all the charges of the undersigned for overhead and profit.

Any additional work performed upon instructions of the Owner by persons other than the subcontractors of the undersigned, the charges will be actual cost of all labor and materials (less all discounts) plus the fee of _______% which includes all the charges of the undersigned for overhead and profit and to which shall be added the actual cost of insurance and taxes.

Each proposal covering extra work shall be accompanied with complete itemized material and labor breakdowns.

For all revisions involving the deletion of contract work, it is agreed that full credit shall be given the Owner for such work deleted, including overhead and profit as quoted hereinbefore.

TIME OF COMPLETION

The undersigned agrees to commence work operations immediately upon award of contract. Date of substantial completion will be determined with the lowest successful bidder.

ADDENDA

If any addenda or bulletins covering changes to the Bidding Documents have been received during the bidding period, the bidder shall fill in their numbers and dates which acknowledges having received same, and having included in this Proposal the work involved:

________________________________________ Dated____________________
________________________________________ Dated____________________
________________________________________ Dated____________________

PROPOSAL FORM - PROPOSAL D 00311 - 3
FERNDALE PUBLIC SCHOOLS  
2017 SINKING FUND PROJECTS  
FERNDALE HS-KITCHEN/SERVING LINE  
AND CAFETERIA RENOVATION  
171745  
JANUARY 12, 2018  

BID SECURITY  

A bid bond executed by a U.S. Treasury Listed Surety Company acceptable to Ferndale Public Schools or a cashier’s check in the amount of at least 5% of the sum of the proposal payable to Ferndale Public Schools shall be submitted with each proposal in excess of $23,417. All proposals shall be firm for a period of sixty (60) days.  

PERFORMANCE AND LABOR BOND  

Successful bidders whose proposals are $50,000 or more will be required to furnish a U.S. Treasury Listed Company Performance and Payment Bond in the amount of 100% of their bid. The cost of the Bond shall be included in each proposal.  

Bidders are to indicate cost of bond on the Bid Form if total bid is less than $50,000. Owner will make a decision if bond is required on all bids less than $50,000.  

The Board of Education reserves the right to reject any and/or all bids in whole or in part and to waive any informality therein. The Board of Education reserves the right to accept that bid which in its opinion, is in the best interest of the Owner.  

FAMILIAL DISCLOSURE  

Bidder has included Section 00401 Familial Disclosure Form (bid will not be read without this form)  

NEGOTIATION  

The undersigned agrees that, should the overall cost exceed the funds available, he will be willing to negotiate with the Owner and Architect for the purpose of making further reductions in the Contract work, and shall agree to give full credit for all such reductions in the work requested by the Owner, including full value of labor, materials, and subcontract work and reasonable proportionate reductions in overhead and profit, thereby arriving at an agreed upon Contract price.
CONTRACT EXECUTION

The undersigned agrees to execute a Contract for work covered by this Proposal, provided that he be notified of its acceptance within sixty (60) days after the opening of bids.

The undersigned hereby declares that he has the legal status checked below:

( ) Individual

( ) Partnership having the following partners:

____________________________________________

____________________________________________

( ) Corporation incorporated under the State laws of:

____________________________________________

This proposal is submitted in the name of, and notice of acceptance should be mailed, faxed, or delivered to:

Date:                        Firm's Name:

__________________________   ____________________________________

Name:                        Phone No.(   )

__________________________   By:

_______________________________

(Signature)

In the presence of:          Title:

_______________________________

END OF SECTION 00311
SECTION 00311 - PROPOSAL FORM - PROPOSAL E

Name of Contractor

Address, City, Zip

Phone # / Fax #

Email Address

PROJECT

FERNDALE PUBLIC SCHOOLS
FERNDALE HIGH SCHOOL
2017 SINKING FUND PROJECTS
Ferndale HS - Kitchen/Serving Line
and Cafeteria Renovation

OWNER

FERNDALE PUBLIC SCHOOLS
871 PINECREST
FERNDALE, MICHIGAN 48220

ARCHITECT

WAKELY ASSOCIATES, INC.
30500 VAN DYKE AVENUE - SUITE 209
WARREN, MI 48093

BASE PROPOSAL - PROPOSAL E: ELECTRICAL

Pursuant to and in compliance with the Invitation to Bid and the Instructions to Bidders, and having carefully examined the Bidding Documents and all Addenda, the undersigned agrees to enter into an agreement with the Owner to complete the work in accordance with the said Bidding Documents for the sum of:

(Sum to be written out)

$___________________
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

Cost of bond (if bid is less than $50,000: if bid is $50,000 or higher, bond cost is to be included in bid)

_____________________________________ Dollars $___________________

ALTERNATES

The undersigned further proposes to execute the work specified in the respective technical division or indicated on the drawings for the sum added to the base proposal as stated below:

Alternate No. 1: Provide cost to perform all work associated with constructing new walls, reconfiguring gas, electrical and plumbing lines, adding food service equipment and all related items in the Kitchen Area 18 as indicated on the drawings.

ADD/DEDUCT/NO CHANGE:__________________________________________

____________________________________Dollars $__________________

ALLOWANCES

The undersigned acknowledges that he has included the allowance identified within this bid category inside the base bid amount for this category for use as a construction contingency at the Owner’s discretion. Any unused amount will be credit back to the Owner via change order at the completion of the project.

VOLUNTARY ALTERNATES

The following voluntary alternates are offered by the bidder. The undersigned agrees that the amounts indicated below shall be added to or deducted from the Base Bid, as the case may be, for each alternate which is accepted.

<table>
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<tr>
<th>Description of Voluntary Alternates</th>
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PRICE GUARANTEE
The undersigned proposes that the price stated in this Proposal is guaranteed for sixty (60) consecutive days from bid date.

TAXES
The undersigned acknowledges that the price stated above includes all taxes of whatever character or description.

SUPPLEMENTAL FEES
For additional work performed upon instruction of the Owner by subcontractors of the undersigned, add to the subcontractor's prices for such additional work a fee of _________% which includes all the charges of the undersigned for overhead and profit.

Any additional work performed upon instructions of the Owner by persons other than the subcontractors of the undersigned, the charges will be actual cost of all labor and materials (less all discounts) plus the fee of _________% which includes all the charges of the undersigned for overhead and profit and to which shall be added the actual cost of insurance and taxes.

Each proposal covering extra work shall be accompanied with complete itemized material and labor breakdowns.

For all revisions involving the deletion of contract work, it is agreed that full credit shall be given the Owner for such work deleted, including overhead and profit as quoted hereinbefore.

TIME OF COMPLETION
The undersigned agrees to commence work operations immediately upon award of contract. Date of substantial completion will be determined with the lowest successful bidder.

ADDENDA
If any addenda or bulletins covering changes to the Bidding Documents have been received during the bidding period, the bidder shall fill in their numbers and dates which acknowledges having received same, and having included in this Proposal the work involved:

________________________________________ Dated____________________
________________________________________ Dated____________________
________________________________________ Dated____________________

BID SECURITY
A bid bond executed by a U.S. Treasury Listed Surety Company acceptable to Ferndale Public Schools or a cashier’s check in the amount of at least 5% of the sum of the proposal payable to Ferndale Public Schools shall be submitted with each proposal in excess of $23,417. All proposals shall be firm for a period of sixty (60) days.

PERFORMANCE AND LABOR BOND

Successful bidders whose proposals are $50,000 or more will be required to furnish a U.S. Treasury Listed Company Performance and Payment Bond in the amount of 100% of their bid. The cost of the Bond shall be included in each proposal.

Bidders are to indicate cost of bond on the Bid Form if total bid is less than $50,000. Owner will make a decision if bond is required on all bids less than $50,000.

The Board of Education reserves the right to reject any and/or all bids in whole or in part and to waive any informality therein. The Board of Education reserves the right to accept that bid which in its opinion, is in the best interest of the Owner.

FAMILIAL DISCLOSURE

Bidder has included Section 00401 Familial Disclosure Form (bid will not be read without this form)

NEGOTIATION

The undersigned agrees that, should the overall cost exceed the funds available, he will be willing to negotiate with the Owner and Architect for the purpose of making further reductions in the Contract work, and shall agree to give full credit for all such reductions in the work requested by the Owner, including full value of labor, materials, and subcontract work and reasonable proportionate reductions in overhead and profit, thereby arriving at an agreed upon Contract price.

CONTRACT EXECUTION
The undersigned agrees to execute a Contract for work covered by this Proposal, provided that he be notified of its acceptance within sixty (60) days after the opening of bids.

The undersigned hereby declares that he has the legal status checked below:

(  ) Individual

(  ) Partnership having the following partners:

____________________________________________
____________________________________________

(  ) Corporation incorporated under the State laws of:

____________________________________________

This proposal is submitted in the name of, and notice of acceptance should be mailed, faxed, or delivered to:

Date:                        Firm's Name:
__________________________   ____________________________
Name:                        Phone No.(   )__________________________
__________________________   By:
_______________________________(Signature)
In the presence of:          Title:
____________________________________________

END OF SECTION 00311
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

SECTION 00311 - PROPOSAL FORM - PROPOSAL F

___________________________________
Name of Contractor

___________________________________
Address, City, Zip

___________________________________
Phone # / Fax #

___________________________________
Email Address

PROJECT

FERNDALE PUBLIC SCHOOLS
FERNDALE HIGH SCHOOL
2017 SINKING FUND PROJECTS
Ferndale HS - Kitchen/Serving Line
and Cafeteria Renovation

OWNER

FERNDALE PUBLIC SCHOOLS
871 PINECREST
FERNDALE, MICHIGAN 48220

ARCHITECT

WAKELY ASSOCIATES, INC.
30500 VAN DYKE AVENUE - SUITE 209
WARREN, MI 48093

BASE PROPOSAL - PROPOSAL F: FOOD SERVICE EQUIPMENT

Pursuant to and in compliance with the Invitation to Bid and the Instructions to Bidders, and having carefully examined the Bidding Documents and all Addenda, the undersigned agrees to enter into an agreement with the Owner to complete the work in accordance with the said Bidding Documents for the sum of:

(Sum to be written out)

Dollars $___________________

Cost of bond (if bid is less than $50,000: if bid is $50,000 or
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION  171745  JANUARY 12, 2018

higher, bond cost is to be included in bid)

_____________________________________ Dollars $___________________

ALTERNATES

The undersigned further proposes to execute the work specified in
the respective technical division or indicated on the drawings for
the sum added to the base proposal as stated below:

Alternate No. FSA1: Provide cost to provide Sneeze Guard Upgrade
per specifications for food service equipment items indicated on
the drawings.

ADD/DEDUCT/NO CHANGE:__________________________________________

____________________________________Dollars $__________________

Alternate No. FSA2: Provide cost to provide Custom Counters in
lieu of Standard Modular Counters per specifications for food
service equipment items indicated on the drawings.

ADD/DEDUCT/NO CHANGE:__________________________________________

____________________________________Dollars $__________________

VOLUNTARY ALTERNATES

The following voluntary alternates are offered by the bidder. The
undersigned agrees that the amounts indicated below shall be added
to or deducted from the Base Bid, as the case may be, for each
alternate which is accepted.

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PRICE GUARANTEE
The undersigned proposes that the price stated in this Proposal is guaranteed for sixty (60) consecutive days from bid date.

TAXES
The undersigned acknowledges that the price stated above includes all taxes of whatever character or description.

SUPPLEMENTAL FEES
For additional work performed upon instruction of the Owner by subcontractors of the undersigned, add to the subcontractor's prices for such additional work a fee of ________% which includes all the charges of the undersigned for overhead and profit.

Any additional work performed upon instructions of the Owner by persons other than the subcontractors of the undersigned, the charges will be actual cost of all labor and materials (less all discounts) plus the fee of ________% which includes all the charges of the undersigned for overhead and profit and to which shall be added the actual cost of insurance and taxes.

Each proposal covering extra work shall be accompanied with complete itemized material and labor breakdowns.

For all revisions involving the deletion of contract work, it is agreed that full credit shall be given the Owner for such work deleted, including overhead and profit as quoted hereinbefore.

TIME OF COMPLETION
The undersigned agrees to commence work operations immediately upon award of contract. Date of substantial completion will be determined with the lowest successful bidder.

ADDENDA
If any addenda or bulletins covering changes to the Bidding Documents have been received during the bidding period, the bidder shall fill in their numbers and dates which acknowledges having received same, and having included in this Proposal the work involved:

________________________________________ Dated____________________

________________________________________ Dated____________________

________________________________________ Dated____________________
BID SECURITY

A bid bond executed by a U.S. Treasury Listed Surety Company acceptable to Ferndale Public Schools or a cashier’s check in the amount of at least 5% of the sum of the proposal payable to Ferndale Public Schools shall be submitted with each proposal in excess of $23,417. All proposals shall be firm for a period of sixty (60) days.

PERFORMANCE AND LABOR BOND

Successful bidders whose proposals are $50,000 or more will be required to furnish a U.S. Treasury Listed Company Performance and Payment Bond in the amount of 100% of their bid. The cost of the Bond shall be included in each proposal.

Bidders are to indicate cost of bond on the Bid Form if total bid is less than $50,000. Owner will make a decision if bond is required on all bids less than $50,000.

The Board of Education reserves the right to reject any and/or all bids in whole or in part and to waive any informality therein. The Board of Education reserves the right to accept that bid which in its opinion, is in the best interest of the Owner.

FAMILIAL DISCLOSURE

Bidder has included Section 00401 Familial Disclosure Form (bid will not be read without this form)

NEGOTIATION

The undersigned agrees that, should the overall cost exceed the funds available, he will be willing to negotiate with the Owner and Architect for the purpose of making further reductions in the Contract work, and shall agree to give full credit for all such reductions in the work requested by the Owner, including full value of labor, materials, and subcontract work and reasonable proportionate reductions in overhead and profit, thereby arriving at an agreed upon Contract price.
CONTRACT EXECUTION

The undersigned agrees to execute a Contract for work covered by this Proposal, provided that he be notified of its acceptance within sixty (60) days after the opening of bids.

The undersigned hereby declares that he has the legal status checked below:

(  ) Individual

(  ) Partnership having the following partners:

____________________________________________

____________________________________________

____________________________________________

(  ) Corporation incorporated under the State laws of:

____________________________________________

This proposal is submitted in the name of, and notice of acceptance should be mailed, faxed, or delivered to:

Date:                        Firm's Name:

__________________________   ____________________________________

Name:                        Phone No.: (   )____________________

__________________________   By:

_______________________________  (Signature)

In the presence of:          Title:

__________________________   ____________________________________

END OF SECTION 00311
SECTION 00401 – FAMILIAL DISCLOSURE FORM

All bidders must complete the following familial disclosure form in compliance with MCL 380.1267 and attach this information to the bid.

By the attached sworn and notarized statement we are disclosing the following familial relationship(s) that exists between the owner or any employee of the bidder and any member of the board, intermediate school board, or board of directors or the superintendent of the school district, intermediate superintendent of the intermediate school district, or chief executive officer of the public school academy. (Ferndale Public Schools shall not accept a bid that does not include this sworn and notarized disclosure statement.)

Disclose any familial relationship and complete the form below in its entirety:

The following are familial relationships as described above (provide employee name, family contact name, family contact position, and familial relationship or NONE.)

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

Signature(s): ___________________________ Title: _________________

Name of Firm:  ___________________________________________________

STATE OF MICHIGAN )
) SS
COUNTY OF )

On this ___ day of ________, 20___, before me a Notary Public in and for said county, personally appeared ________________, and who acknowledged the same to be his free act and deed as such agent.

Notary Public

END OF SECTION 00401
AFFIDAVIT OF COMPLIANCE – IRAN ECONOMIC SANCTIONS ACT
Michigan Public Act No. 517 of 2012

The undersigned, the owner or authorized officer of the below-named Contractor, pursuant to the compliance certification requirement provided in the Ferndale Public Schools (the “Owner”) Request For Proposals For Construction Services (the “RFP”), hereby certifies, represents and warrants that the Contractor (including its officers, directors and employees) is not an “Iran linked business” within the meaning of the Iran Economic Sanction Act, Michigan Public Act No. 517 of 2012 (the “Act”), and that in the event the Contractor is awarded a contract as a result of the aforementioned RFP, the Contractor will not become an “Iran linked business” at any time during the course of performing any services under the contract.

The Contractor 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 Owner’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 a request for proposal for three (3) years from the date that it is determined that the person has submitted the false certification.

____________________________________
Name of Contractor

By: ________________________________
Its: ________________________________
Date: ______________________________

State of_________________) )SS.
County of _______________)

This instrument was acknowledged before me on the _____ day of _______, 2017, by___________________________________.

____________________________________
Notary Public

__________________County,__________________

My commission expires on _____________

Acting in the County of ______________
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

SECTION 00710 - GENERAL CONDITIONS

DOCUMENTS:

"The General Conditions of the Contract for the Construction"
A.I.A. Documents A-201, 2007 Edition, Forms a part of these
Specifications and shall have the same effect as if bound herein.

This Document is modified as described in Modifications of the
General Conditions.

Contractors shall be held responsible for having familiarized
themselves with this Document and all other documents affecting
their contracts in this Specification.

END OF SECTION 00710
SECTION 00810 - MODIFICATIONS OF THE GENERAL CONDITIONS

The following modify, change, delete from, or add to the "General Conditions of the Contract for Construction" AIA Document A201, 2007 Edition. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of that Article, Paragraph, Subparagraph, or Clause shall remain in effect.

ARTICLE 1, GENERAL PROVISIONS

Add the following Subparagraph to Paragraph 1:

1.2.4 Work not covered in the Contract Documents will not be required, unless it is consistent therewith and is reasonably inferable therefrom as being necessary to produce the intended results. Where reference is made to specifications of manufacturers, trade associations or the like, such is understood to be made a part of this Specification to have the same effect as if fully reproduced herein. Approval or equal, acceptable, and words of similar definition are understood to mean in the judgment of Architect.

Add the following Subparagraph to Paragraph 1:

1.2.5 Computed dimensions take precedence over scaled dimensions, large scale details over smaller; should disagreements occur in the drawings, or the Specifications describe a higher quality of work or material, the better quality shall be estimated, unless otherwise directed by the Architect. The Architect shall be notified at once, in writing, of any and all discrepancies.

ARTICLE 3, CONTRACTOR

Add the following Subparagraph to paragraph 3:

3.4.4 After the Contract has been executed, the Owner and the Architect will consider a formal written request for the substitution of products in place of those specified only under the conditions set forth herein.
3.4.5 By making requests for substitutions based on Clause 3.1.3. above, the Contractor:

(a) represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;

(b) represents that he will provide the same warranty for the substitution that he would for that specified;

(c) certifies that the cost data presented is complete and includes all related costs under this Contract, but excludes cost under separate contract, and excludes the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently becomes apparent; and

(d) will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.

Change Paragraph 3.7, Subparagraph 1, to read as follows:

3.7.1 General Trades Contractor shall secure and Owner pay for general building permit review through the State Agencies (BFS & BCC). General, Mechanical and Electrical Trades Contractors shall secure and pay for all other permits and governmental fees, licenses and inspections as their work may require for the proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required at the time the bids are received.

3.7.1.1. Owner will pay for all sewer and water escrow fees, capital charges, assessment fees, and frontage fees.

3.7.1.2. All other fees, permits and tapping charges shall be applied for and obtained by Mechanical Trades Contractor, and shall be paid for by the Owner.
ARTICLE 5, SUBCONTRACTOR
Add the following Subparagraph to Paragraph 5:

5.2.1.1. No later than (10) days after the award of contract the Contractor shall furnish, in writing to the Owner through the Architect the names of persons or entities proposed or manufacturers for each of the products identified in the General Requirements (Division of the Specifications) and where applicable, the name of the installing subcontractor.

Article 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
6.1.1 Delete reference to waiver of subrogation as follows:
The Owner reserves the right to perform construction or operations related to the Project with the Owner’s own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such claim as provided in Article 15.

Article 7, CHANGES IN THE WORK
Add the following sentence to paragraph 7.3.7

7.3.7.6 The Contractor shall not incur any cost to be reimbursed as part of the adjustment in the contract sum prior to the commencement of the construction phase.

ARTICLE 8, TIME
8.3.1 Delete reference to arbitration.

ARTICLE 9, PAYMENTS AND COMPLETION
Add the following sentence to Subparagraph 9.3.1.:
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.

Add the following Clause 9.3.1.3. to 9.3.1:

Until the work is 50% complete, the Owner shall pay 90% of the amount due the Contractor on account of progress payments. At the time the work is 50% complete and thereafter, the Architect may, upon written request and satisfactory progress authorize remaining partial payments to be paid in full.
ARTICLE 11, INSURANCE AND BONDS

Add the following Subparagraph:

11.1.1.9. Liability Insurance shall include all major divisions of coverage on a comprehensive basis including:

   (1) Premised-Operations (including X-C-U)
   (2) Independent Contractors Protective
   (3) Products and Completed Operations
   (4) Personal Injury Liability with Employment Exclusion deleted.
   (5) Contractual-including specified provisions for Contractor's Obligation under Paragraph 3-18
   (6) Owned, non-owned, and hired motor vehicles.
   (7) Broad Form Property Damage, including Complete Operations.

Add the following Subparagraph:

11.1.1.1. 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.

Add the following Subparagraph:

11.1.2.1. The Insurance required by Subparagraph 11.1.1. shall be written for not less than any limits of liability specified in the Contract Documents, or required by law, whichever is greater. Provide minimum limits as follows:

   (1) Worker's Compensation:
       (a) State - statutory
       (b) Applicable Federal - statutory
       (c) Employer's Liability - $100,000
       (d) Benefits required by Labor Union Contracts.
(2) Comprehensive General Liability, including Premises-Operations, Independent Contractor's Protective, Products and Completed Operations, and Broad Form Property Damage:

(a) General Policy: $2,000,000 aggregate

(b) Bodily Injury:

$1,000,000 Each Occurrence  
$1,000,000 Aggregate Products and Completed Operations

(c) Property Damage:

$1,000,000 Each Occurrence  
$1,000,000 Aggregate

(d) Product and Completed Operations Insurance shall be maintained for a minimum period of one year after final payment, and Contractor shall continue to provide evidence of such coverage to Owner on an annual basis during the coverage period. Name Ferndale Public Schools as additionally insured primary coverage.

(e) Property Damage Liability Insurance shall include coverage for X (Explosion), C (Collapse) and U (Underground).

(f) Contractual Liability (Hold Harmless Coverage):

Bodily Injury - $1,000,000 Each Occurrence  
Property Damage - $1,000,000 Each Occurrence  
$1,000,000 Aggregate

(g) Personal Injury with Employment Exclusion deleted:

$1,000,000 Aggregate
(3) Comprehensive Automotive Liability (Owner, non-owned, hired):

(a) Bodily Injury:

$500,000 Each Person
$1,000,000 Each Accident

(b) Property Damage:

$1,000,000 Each Occurrence

Add the following sentence to Subparagraph 11.1.3.:

If this Insurance is written on the Comprehensive General Liability Policy form, the Certificates shall be AIA Document G705, Certificates of Insurance. If this Insurance is written on a Commercial General Liability Policy form, ACORD form 255 will be acceptable.

Add the following sentence to Clause 11.3.1.1.:

The form of policy for this coverage shall be Complete Value.

Delete Clause 11.3.1.4 and substitute the following:

11.3.1.4 The Contractor shall provide insurance coverage for portions of the Work stored off the site after written approval of the Owner at the value established in the approval, and also for portions of the Work in transit.

11.3.5 Delete in its entirety.

11.3.7 Waiver of subrogation. Delete in its entirety.

11.3.9 Revise third sentence to read:

The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or in accordance with a mediation or litigation award in which case the procedure shall be as directed by the mediator or the Court.

11.3.10 Revise second sentence to read:

The Owner as fiduciary shall in the case of mediation or litigation make settlement with insurers in accordance with the directions of the mediator or the Court. If distribution of insurance proceeds by mediation or litigation is required the mediator or the Court will direct such distribution.
Add clause 11.3.11 as follows:

The parties agree that the Owner is not waiving any rights in insurer(s) may have to subrogation. To the extent any term in this Agreement is contrary to this provision, such term is void and unenforceable.

11.4, PERFORMANCE BOND AND PAYMENT BOND

Delete Subparagraph 11.4.1 and substitute the following paragraphs:

11.4.1 For all bids of $50,000 or more; The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising hereunder. Bonds may be obtained through the Contractor's usual source 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. For bids less than $50,000, the Owner will direct the Contractor if a bond is required. Bonds may be obtained through the Contractor’s usual source and cost thereof is to be indicated on the bond form. If desired by the Owner, the bond amount indicated on the bid form will be added to the contract.

11.4.1.1 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.

11.4.1.2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

Add the following Paragraph 13.8 to Article 13:

13.8 EQUAL OPPORTUNITY

13.8.1 The Contractor shall maintain policies of employment as follows:

13.8.1.1 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.

13.8.1.2 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.

ARTICLE 15, CLAIMS AND DISPUTES
15.3 Mediation

15.3.2 Delete reference to Arbitration and substitute litigation.

15.3.2 Revise paragraph to read:

The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Mediation Rules of the American Arbitration Association in effect on the date of this agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the American Arbitration Association. The request may be made concurrently with the filing for litigation but, in such event, mediation shall proceed in advance of litigation or legal or equitable 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.

15.4 Delete reference to arbitration. Binding dispute resolution shall be by litigation in a court of law having jurisdiction.

15.4.4 CONSOLIDATION OR JOINDER

15.4.4.1, 15.4.4.2, 15.4.4.3
Delete reference to arbitration and substitute mediation

END OF SECTION 00810
The following drawings, dated January 12, 2018, are issued for Ferndale Public Schools, 2017 Sinking Fund Projects, FERNADE HIGH SCHOOL-KITCHEN/SERVING LINE AND CAFETERIA RENOVATION, Ferndale, Michigan. Architect's Project Number 171745.

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<td>00851</td>
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### HIGH SCHOOL

#### GENERAL DRAWINGS:
- G0.0 COVER SHEET, SHEET INDEX AND LOCATION MAP
- G4.1 GENERAL INFORMATION, SYMBOLS AND ABBREVIATIONS

#### ARCHITECTURAL DRAWINGS:
- A1.0 COMPOSITE PLAN
- AD1.1 FLOOR PLAN - DEMOLITION
- A1.1 FLOOR PLAN - NEW WORK
- A2.1 REFLECTED CEILING PLAN
- A3.1 INTERIOR ELEVATIONS
- A4.1 ENLARGED PLAN AND DETAILS
- A5.1 WALL SECTIONS AND DETAILS
- A7.1 ROOM FINISH SCHEDULE, DOOR SCHEDULE, SIGNAGE SCHEDULE AND DETAILS

#### FOOD SERVICE EQUIPMENT:
- FSE-1 FOOD SERVICE EQUIPMENT ITEM SCHEDULE
- FSE-2 FOOD SERVICE EQUIPMENT LAYOUT
- FSE-3 FOOD SERVICE EQUIPMENT ELECTRICAL ROUGH-IN PLAN
- FSE-4 FOOD SERVICE EQUIPMENT PLUMBING ROUGH-IN PLAN

#### MECHANICAL DRAWINGS:
- M0.1 MECHANICAL STANDARDS AND DRAWING INDEX
- MD1.0 BASEMENT MECHANICAL DEMOLITION PLAN
- MD1.1 LOWER LEVEL MECHANICAL DEMOLITION PLAN
- M2.0 BASEMENT PLUMBING PLAN
- M2.1 LOWER LEVEL PLUMBING PLAN
- M4.0 BASEMENT MECHANICAL PLAN
- M4.1 LOWER LEVEL MECHANICAL PLAN
- M6.1 MECHANICAL DETAILS
- M7.1 MECHANICAL SCHEDULES
ELECTRICAL DRAWINGS:

E0.1   ELECTRICAL STANDARDS AND DRAWING INDEX
E0.2   ELECTRICAL STANDARD SCHEDULES AND DETAILS
E0.3   LOWER LEVEL ELECTRICAL COMPOSITE PLAN
ED1.1  LOWER LEVEL ELECTRICAL DEMOLITION PLAN
E2.1   LOWER LEVEL LIGHTING PLAN
E3.1   LOWER LEVEL POWER AND AUXILIARY PLAN
E5.1   ONE LINE DIAGRAM
E7.1   ELECTRICAL DETAILS

END OF SECTION 00851
In addition to the above, this bid category includes but is not limited to the Bidding Documents, the Bidding and Contract requirement sand Division 1 General Requirements of the Project Manual and various other Technical Specifications interfacing with this work. The bidder is advised to review the work descriptions of the other categories and other referenced documents so as to not misunderstand scope responsibilities.

<table>
<thead>
<tr>
<th>Specification Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02070</td>
<td>Selective Demolition</td>
</tr>
<tr>
<td>03001</td>
<td>Concrete</td>
</tr>
<tr>
<td>03300</td>
<td>Bonding Agents for Concrete</td>
</tr>
<tr>
<td>04100</td>
<td>Mortar and Grout</td>
</tr>
<tr>
<td>04270</td>
<td>Glass Unit Masonry</td>
</tr>
<tr>
<td>04300</td>
<td>Unit Masonry</td>
</tr>
<tr>
<td>05400</td>
<td>Cold Formed Metal Framing</td>
</tr>
<tr>
<td>05500</td>
<td>Metal Fabrications</td>
</tr>
<tr>
<td>06100</td>
<td>Carpentry</td>
</tr>
<tr>
<td>06402</td>
<td>Interior Architectural Woodwork</td>
</tr>
<tr>
<td>07200</td>
<td>Insulation</td>
</tr>
<tr>
<td>07840</td>
<td>Firestopping</td>
</tr>
<tr>
<td>07910</td>
<td>Joint Fillers &amp; Gaskets</td>
</tr>
<tr>
<td>07920</td>
<td>Sealants &amp; Caulking</td>
</tr>
<tr>
<td>08112</td>
<td>Hollow Metal Work</td>
</tr>
<tr>
<td>08210</td>
<td>Wood Doors</td>
</tr>
<tr>
<td>08710</td>
<td>Finish Hardware &amp; Door Index</td>
</tr>
<tr>
<td>08800</td>
<td>Glass &amp; Glazing</td>
</tr>
<tr>
<td>08810</td>
<td>Fire Rated Glass</td>
</tr>
<tr>
<td>09250</td>
<td>Gypsum Drywall</td>
</tr>
<tr>
<td>09510</td>
<td>Acoustical Ceilings</td>
</tr>
<tr>
<td>09650</td>
<td>Resilient Flooring</td>
</tr>
<tr>
<td>09900</td>
<td>Painting</td>
</tr>
<tr>
<td>10400</td>
<td>Identification Devices</td>
</tr>
<tr>
<td>10999</td>
<td>Miscellaneous Specialties</td>
</tr>
<tr>
<td>12300</td>
<td>Plastic Laminate Casework</td>
</tr>
</tbody>
</table>
THE SCOPE OF THIS BID CATEGORY SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING ITEMS:

1. Requirements of items included under General Work to be completed by all contractors.
2. This contractor shall be responsible for all layout, engineering, and elevations and layout coordination with other contractors. It is the responsibility of this contractor to layout all work of this category.
3. This contractor is responsible for scheduling inspections of all governing jurisdictions (except for Bureau of Fire Services which Architect will arrange) and attend inspections as required.
4. Strict enforcement of this contractor’s requirement to provide timely clean-up, removal and disposal of all rubbish and debris generated by this trade during the work. Maintain a clean condition at all areas on site and free from dirt, mud, and gravel.
5. This contractor is responsible to provide a dumpster and/or legal disposal of all their own debris and clean up as required.
6. Provide all labor and equipment necessary for the complete scope of work as shown within the Construction Documents unless specifically noted to be completed by others. Work includes but not limited to: Remodeling of existing Cafeteria and Serving Line including new finishes, stair construction, wall construction, food service equipment, mechanical systems, plumbing systems, electrical systems, demolition of existing items, installation of new items, as indicated in the bid documents.
7. Remove and legally dispose of all excess materials and debris generated by scope of work.
8. Obtain all permits and approvals for the work of this category as with the State of Michigan Bureau of Construction Codes (BCC) as required, Owner will reimburse costs of all permits.
9. Provide all Shop Drawings, Submittals & Samples as indicated, specified & required.
10. Provide all lay out required for the work of this contract & coordination with all other trades for the work of this category.
11. Provide all barricades, traffic control & safety devices as required to maintain public and job site safety throughout the duration of this work, as required for the work of this category.
12. Provide temporary 60 minute fire rated, smoke tight partitions with 60 minute fire rated access door assemblies in areas indicated to separate construction areas form occupied areas during the construction.
13. Provide all saw cutting and floor coring as required for the work of this category.
14. Protection of all surrounding & adjacent surfaces and/or items that are existing to remain and restoration of any existing and adjacent areas that are disturbed and/or damaged by the work of this category. Areas disturbed shall be restored to their original condition by this category.
15. It is the responsibility of this Bid Category to review all drawings and drawing notes, including architectural, mechanical and electrical drawings, and include items requiring work that is generally defined as the responsibility of this Bid Category within the work description unless otherwise noted above in the scope of work.
16. This contactor will be responsible for all re-mobilization costs for all phases of work.
17. This contractor is to provide all legal disposal off-site of the debris that is a result of their work.
18. Coordination with other trades, including mandatory participation in job meetings.
19. Coordinate the location and sizes of all openings with the appropriate trades.
20. Perform all selective demolition work as indicated, specified & required.
21. Furnish, install and maintain all shoring and bracing as required. Leave shoring in place until new building systems are in place and then remove as required. Prior to installation of shoring and bracing efforts, provide shop drawings on the proposed shoring and bracing design. A registered engineer in the State of Michigan must seal drawings.
22. Perform all trimming and adjusting of work for installation of new construction. Coordinate limits of wall demolition
with architectural drawings and all critical trade contractors.

23. Provide all lay out required for the work of this contract & coordination with all other trades for the work of this category. Owner will provide major control point lay-out.

24. Coordinate with Architect/Engineer before penetrating any structural members.

25. The contractor’s field superintendent shall be present during testing, inspections and field reviews conducted by the various inspection agencies.

26. This contractor shall furnish, upon completion of work, as-built mylar drawings showing the actual installation of the work as completed.

27. Furnish and install all concrete foundation systems and floors as indicated, specified and required; inclusive of strip/spread footings, walls, stair foundations and step construction, formwork, reinforcing steel, set all anchor bolts and grout leveling plates, etc. to produce a complete system.

28. Provide all rough and finish carpentry work complete as indicated, specified and required; inclusive of all required materials, fasteners and anchors.

29. Provide all cabinetry, millwork, solid surfaced and manufactured casework complete as indicated, specified and required; inclusive of all fixed cabinetry, work surfaces, etc.

30. Provide all light gage metal framing complete as indicated, specified and required; inclusive of all sheathing, etc. ready for finishing or subsequent trades.

31. Provide all joint sealant and caulking work complete as indicated, specified and required.

32. Provide all metal stud and gypsum wall board work complete as indicated, specified and required; inclusive of all insulation within metal stud partitions. Refer to plans for fire rated partition locations.

33. Provide all concrete masonry unit and glass block unit installation complete as indicated, specified and required.

34. Provide all acoustical ceiling system work complete as indicated, specified and required.

35. Provide new flooring and base systems complete as indicated, specified and required, inclusive of all floor
prep indicated or required by flooring manufacturer to maintain warranties.

36. Provide all painting, epoxy painting, epoxy floor painting, complete as indicated, specified and required; inclusive of wall preparation required for proper adhesion of new coatings per manufacturers recommendations.

37. Provide all sliding gate partitions complete with tracks, pocket doors, etc. as indicated, specified and required.

38. Provide all signage complete as indicated, specified and required; inclusive of all door and room identification signage.

39. Provide all doors, frames and hardware complete as indicated, specified and required; inclusive of hollow metal frames and doors, wood doors and finish hardware, final cores and keying by Owner.

40. Removal and vacuuming of all dust generated by sanding/finishing of drywall systems.

41. Provide all building, thermal, sound and firestop insulation complete as indicated, specified and required; inclusive of all fiberglass batt insulation, rigid insulation adhered to substrates other than masonry and firestop insulation.

42. Daily clean-up and removal of debris generated by the work of this category and placed in dumpsters. All bulky items and boxes shall be broken down prior to placement in dumpsters. Debris will not be allowed to accumulate on the site or inside the buildings.

43. Provide temporary protection of Owner’s personnel, general public and property during construction.

44. Restore site to existing or new condition as complete of work. Clean any and all areas affected during construction operations.

45. Provide all required closeout documents upon completion of project.

46. Provide three sets of material submittals for approval. If submittals comply with specifications, “Material Compliance Certificate” shall be used.

47. **Note:** Milestone Schedule. This trade will be required to provide a detailed schedule upon award of this contract.

48. **Provide quotation for the following Alternates:***
   a. **Alternate No. 1:** Provide cost to perform all work associated with constructing new walls, reconfiguring
gas, electrical and plumbing lines, adding food service equipment and all related items in the Kitchen Area 18 as indicated on the drawings.

49. This Contractor is to include the sum of Ten Thousand Dollars ($10,000.00) in the base bid amount for this category for use as a construction allowance at the Owner’s discretion. Any amount not used during the course of the project, shall be returned to the Owner upon completion of the project by issuance of a credit change order.
In addition to the above, this bid category includes but is not limited to the Bidding Documents, the Bidding and Contract requirements and Division 1 General Requirements of the Project Manual and various other Technical Specifications interfacing with this work. The bidder is advised to review the work descriptions of the other categories and other referenced documents so as to not misunderstand scope responsibilities.

THE SCOPE OF THIS BID CATEGORY SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING ITEMS:

1. Requirements of items included under General Work to be completed by all contractors.
2. This contractor shall be responsible for all layout, engineering, and elevations and layout coordination with other contractors. It is the responsibility of this contractor to layout all work of this category.
3. Coordinate work with other trades on site.
4. Strict enforcement of this contractor’s requirement to provide timely clean-up, removal and disposal of all rubbish and debris generated by this trade during the work. Maintain a clean condition at all areas on site and free from dirt, mud, and gravel.
5. This contractor is responsible to provide a dumpster and/or legal disposal of all their own debris and clean up as required.
6. Provide all labor and equipment necessary for the complete scope of work as shown within the Construction Documents unless specifically noted to be completed by others. Work includes but not limited to: Complete installation of hard tile to existing Cafeteria and Serving Line areas including
existing wall surfaces, new wall surfaces, new stair
construction, etc., as indicated in the bid documents.
7. Remove and legally dispose of all excess materials and
debris generated by scope of work.
8. Provide temporary protection of Owner’s personnel, general
public and property during construction.
9. Provide all required closeout documents upon completion of
project.
10. Provide three sets of material submittals for approval. If
submittals comply with specifications, “Material Compliance
Certificate” shall be used.
11. Note: Milestone Schedule. This trade will be required to
provide a detailed schedule upon award of this contract.
12. This Contractor is to include the sum of Three Thousand
Dollars ($3,000.00) in the base bid amount for this
category for use as a construction allowance at the Owner’s
discretion. Any amount not used during the course of the
project, shall be returned to the Owner upon completion of
the project by issuance of a credit change order.
In addition to the above, this bid category includes but is not limited to the Bidding Documents, the Bidding and Contract requirements sand Division 1 General Requirements of the Project Manual and various other Technical Specifications interfacing with this work. The bidder is advised to review the work descriptions of the other categories and other referenced documents so as to not misunderstand scope responsibilities.

THE SCOPE OF THIS BID CATEGORY SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING ITEMS:

1. Requirements of items included under General Work to be completed by all contractors.
2. Coordinate work with other trades on site.
3. Strict enforcement of this contractor’s requirement to provide timely clean-up, removal and disposal of all rubbish and debris generated by this trade during the work. Maintain a clean condition at all areas on site and free from dirt, mud, and gravel.
4. This contractor is responsible to provide a dumpster and/or legal disposal of all their own debris and clean up as required.
5. Provide all labor and equipment necessary for the complete scope of work as shown within the Construction Documents unless specifically noted to be completed by others. Work includes but not limited to: Grinding and polishing of existing terrazzo floors and bases in rooms indicated on the drawings. Including crack repair as indicated in the bid documents.
6. Remove and legally dispose of all excess materials and debris generated by scope of work.
7. Provide temporary protection of Owner’s personnel, general public and property during construction.
8. Restore site to existing or new condition as complete of work. Clean any and all areas affected during construction operations.

9. Provide all required closeout documents upon completion of project.

10. Provide three sets of material submittals for approval. If submittals comply with specifications, “Material Compliance Certificate” shall be used.

11. **Note: Milestone Schedule. This trade will be required to provide a detailed schedule upon award of this contract.**

12. Provide quotation for the following Alternates:
   
   **a. Alternate No. 2:** Provide cost to grind and polish all terrazzo floors in the Cafeteria 01, Serving 09, Corridor 17 and Kitchen Area 18 as indicated on the drawings.

13. Include in Base Bid amount the following lineal footage of crack repair as indicated in the Specifications: 800 total for Cafeteria Room 01.

14. Include in Alternate No. 2 amount the following lineal footage of crack repair as indicated in the Specifications: 100 LF total for Serving 09, Corridor 17 and Kitchen 18.
## PROPOSAL D: FERNDALE HS-CAFETERIA AND SERVING LINE RENOVATION

<table>
<thead>
<tr>
<th>Division 0 Bidding &amp; Contract Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division 1 General Requirements</td>
</tr>
<tr>
<td>Specification Section 02070</td>
</tr>
<tr>
<td>Specification Section 15010</td>
</tr>
<tr>
<td>Specification Section 15050</td>
</tr>
<tr>
<td>Specification Section 15053</td>
</tr>
<tr>
<td>Specification Section 15055</td>
</tr>
<tr>
<td>Specification Section 15060</td>
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<td>Specification Section 15075</td>
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<td>Specification Section 15140</td>
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<td>Specification Section 15145</td>
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<td>Specification Section 15155</td>
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<td>Specification Section 15181</td>
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<tr>
<td>Specification Section 15188</td>
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<tr>
<td>Specification Section 15189</td>
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<tr>
<td>Specification Section 15194</td>
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<tr>
<td>Specification Section 15441</td>
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<tr>
<td>Specification Section 15485</td>
</tr>
<tr>
<td>Specification Section 15761</td>
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</tr>
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<td>Specification Section 15820</td>
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<tr>
<td>Specification Section 15855</td>
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<td>Specification Section 15950</td>
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</tbody>
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In addition to the above, this bid category includes but is not limited to the Bidding Documents, the Bidding and Contract requirement sand Division 1 General Requirements of the Project Manual and various other Technical Specifications interfacing with this work. The bidder is advised to review the work descriptions of the other categories and other referenced documents so as to not misunderstand scope responsibilities.

THE SCOPE OF THIS BID CATEGORY SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING ITEMS:

1. Requirements of items included under General Work to be completed by all contractors.
2. This contractor shall be responsible for all layout, engineering, and elevations and layout coordination with other contractors. It is the responsibility of this contractor to layout all work of this category.
3. This contractor is responsible for scheduling inspections of all governing jurisdictions (except for Bureau of Fire Services which Architect will arrange) and attend inspections as required.
4. Coordinate work with other trades on site.
5. Strict enforcement of this contractor’s requirement to provide timely clean-up, removal and disposal of all rubbish and debris generated by this trade during the work. Maintain a clean condition at all areas on site and free from dirt, mud, and gravel.
6. This contractor is responsible to provide a dumpster and/or legal disposal of all their own debris and clean up as required.
7. Provide all labor and equipment necessary for the complete scope of work as shown within the Construction Documents unless specifically noted to be completed by others. Work includes but not limited to: Remodeling of existing Cafeteria and Serving Line including new finishes, stair construction, wall construction, food service equipment, mechanical systems, plumbing systems, electrical systems, demolition of existing items, installation of new items, as indicated in the bid documents.
8. Remove and legally dispose of all excess materials and debris generated by scope of work.
9. Provide temporary protection of Owner’s personnel, general public and property during construction.
10. Obtain all permits and approvals for the work of this category as with the State of Michigan Bureau of Construction Codes (BCC) as required, Owner will reimburse costs of all permits.
11. Provide all Shop Drawings, Submittals & Samples as indicated, specified and required.
12. Provide all lay out required for the work of this contract & coordination with all other trades for the work of this category.
13. Provide all barricades, traffic control & safety devices required to maintain public and job site safety throughout the duration of this work.
14. Provide all saw cutting and coring as required for the work of this category.
15. Protection of all surrounding & adjacent surfaces and/or items that are existing to remain and restoration of any existing and adjacent areas that are disturbed and/or damaged by the work of this category. Areas disturbed shall be restored to their original condition by this category.
16. It is the responsibility of this Bid Category to review all drawings and drawing notes, including architectural, mechanical and electrical drawings, and include items requiring work that is generally defined as the responsibility of this Bid Category within the work description unless otherwise noted above in the scope of work.
17. This contactor will be responsible for all re-mobilization costs for all phases of work.
18. Coordination with other trades, including mandatory participation in job meetings.
19. Coordinate the location and sizes of all openings with the appropriate trades.
20. Perform all demolition work as described on the Demolition Drawings and noted in the Demolition Notes.
21. Coordinate with other trades, which may require holes or special anchorage to steel members.
22. Contractor will be responsible for delivery, off-loading and storage of all materials for this work.
23. Remove tags, labels and sticker and clean all surfaces after fixtures and devices are installed.
24. Furnish and install all insulation required for the work of this category.
25. Coordinate all embedded items incorporated in this work including, but not limited to, mechanical and electrical equipment for proper alignment leveling and access.
26. Provide all plumbing systems complete as indicated, specified and required and as follows:
   A) All excavation, backfill, compaction floor coring, etc. as required.
   B) All underground sanitary system piping inclusive of connections to service mains as indicated on bid documents.
   C) All above ground sanitary, vent and storm piping.
   D) All domestic water system, inclusive of piping, valving, water heaters, pumps, back flow prevention and water services and meter modifications/revisions.
   E) All gas piping, valving and meter and service modifications/revisions.
   F) All fixtures inclusive of toilets, urinals, lavs, wash basins, kitchen sinks, slop sinks, service sinks, water fountain/bubblers, electric water coolers, roof sumps, floor drains and clean-outs.
   G) All patching, firestopping and fire caulking of all openings created for this work.
   H) Caulking of all fixtures.
   I) All required testing of systems installed by this category.
   J) Provide identification and flow directions for all piping and valves installed by this category; inclusive of a valve schedule.
   K) Be onsite during concrete floor slab placement to assure all floor roughs, drains, clean-outs, etc. remain at the correct elevations.
   L) Provide detailed as-built drawings inclusive for accurate dimensioning, locations and elevations.
   M) Provide operational manuals and care and maintenance instructions for all equipment installed by this category.
   N) Provide owner training for all systems, equipment and devices installed by this category.
27. Daily clean-up and removal of debris generated by the work of this category and placed in dumpsters. All bulky items and boxes shall be broken down prior to placement in
dumpsters. Debris will not be allowed to accommodate on the site or inside the buildings.

28. Provide all HVAC & Control Systems complete as indicated and specified in the bid documents:
   A) All heating, ventilating and air conditioning systems complete; inclusive of all sheet metal, fabric and flexible ductwork, distribution boxes, grilles, registers, diffusers, insulation and duct detectors.
   B) All venting, piping, pumps, valves, pressure controls, backflow preventions and insulation.
   C) All exhaust systems complete; inclusive of sheet metal and flexible ductwork, grilles, registers, diffusers and insulation.
   D) All self-contained air conditioning systems complete; inclusive of condensate piping.
   E) All condensate piping complete for all equipment installed by this category.
   F) Furnish and install all mechanical equipment complete; inclusive for all exhaust fans, distribution boxes and devices, dampers, louvers and duct detectors, etc.
   G) All control systems complete; inclusive of all required conduit, and low voltage wiring.
   H) All insulation complete for all work installed by this category.
   I) All required testing of systems installed by this category.
   J) All patching, fire stopping and fire caulking of all openings created for this work.
   K) Provide identification and flow directions for all piping, valves and equipment installed by this category; inclusive of a valve schedule.
   L) Provide detailed as-built drawings inclusive of accurate dimensioning, locations and elevations.
   M) Provide operational manuals and care and maintenance instructions for all equipment and devices installed by this category.

29. Restore site to existing or new condition as complete of work. Clean any and all areas affected during construction operations.

30. Provide all required closeout documents upon completion of project.
31. Provide three sets of material submittals for approval. If submittals comply with specifications, “Material Compliance Certificate” shall be used.

32. Note: Milestone Schedule. This trade will be required to provide a detailed schedule upon award of this contract.

33. Provide quotation for the following Alternates:
   a. **Alternate No. 1**: Provide cost to perform all work associated with constructing new walls, reconfiguring gas, electrical and plumbing lines, adding food service equipment and all related items in the Kitchen Area 18 as indicated on the drawings.

34. This Contractor is to include the sum of Five Thousand Dollars ($5,000.00) in the base bid amount for this category for use as a construction allowance at the Owner’s discretion. Any amount not used during the course of the project, shall be returned to the Owner upon completion of the project by issuance of a credit change order.
### PROPOSAL E: FERNDALE HS-CAFETERIA AND SERVING LINE RENOVATION

<table>
<thead>
<tr>
<th>Division 0 Bidding &amp; Contract Requirements</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Division 1 General Requirements</td>
<td></td>
</tr>
<tr>
<td>Specification Section 02070</td>
<td>Selective Demolition</td>
</tr>
<tr>
<td>Specification Section 16010</td>
<td>Electrical General Requirements</td>
</tr>
<tr>
<td>Specification Section 16060</td>
<td>Grounding and Bonding</td>
</tr>
<tr>
<td>Specification Section 16073</td>
<td>Hangers and Supports</td>
</tr>
<tr>
<td>Specification Section 16075</td>
<td>Electrical Identification</td>
</tr>
<tr>
<td>Specification Section 16120</td>
<td>Conductors and Cables</td>
</tr>
<tr>
<td>Specification Section 16130</td>
<td>Raceways and Boxes</td>
</tr>
<tr>
<td>Specification Section 16140</td>
<td>Wiring Devices</td>
</tr>
<tr>
<td>Specification Section 16145</td>
<td>Lighting Control Devices</td>
</tr>
<tr>
<td>Specification Section 16442</td>
<td>Panelboards</td>
</tr>
<tr>
<td>Specification Section 16461</td>
<td>Dry-Type Transformers</td>
</tr>
<tr>
<td>Specification Section 16511</td>
<td>Interior Lighting</td>
</tr>
<tr>
<td>Specification Section 16570</td>
<td>Dimming Controls</td>
</tr>
<tr>
<td>Specification Section 16721</td>
<td>Fire Alarm</td>
</tr>
<tr>
<td>Specification Section 16723</td>
<td>School Intercom and Program Equipment</td>
</tr>
</tbody>
</table>

In addition to the above, this bid category includes but is not limited to the Bidding Documents, the Bidding and Contract requirements and Division 1 General Requirements of the Project Manual and various other Technical Specifications interfacing with this work. The bidder is advised to review the work descriptions of the other categories and other referenced documents so as to not misunderstand scope responsibilities.

**THE SCOPE OF THIS BID CATEGORY SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING ITEMS:**

**General Scope of Work:**
1. Requirements of items included under General Work to be completed by all contractors.
2. This contractor shall be responsible for all layout, engineering, and elevations and layout coordination with...
other contractors. It is the responsibility of this contractor to layout all work of this category.

3. This contractor is responsible for scheduling inspections of all governing jurisdictions (except for Bureau of Fire Services which Architect will arrange) and attend inspections as required.

4. Coordinate work with other trades on site.

5. Strict enforcement of this contractor’s requirement to provide timely clean-up, removal and disposal of all rubbish and debris generated by this trade during the work. Maintain a clean condition at all areas on site and free from dirt, mud, and gravel.

6. This contractor is responsible to provide a dumpster and/or legal disposal of all their own debris and clean up as required.

7. Remove and legally dispose of all excess materials and debris generated by scope of work.

8. Provide temporary protection of Owner’s personnel, general public and property during construction.

9. Provide All Shop Drawings, Submittals & Samples as indicated, specified & required.

10. It is the responsibility of this Bid Category to review all drawings and drawing notes, including architectural, mechanical and electrical drawings, and include items requiring work that is generally defined as the responsibility of this Bid Category within the work description unless otherwise noted above in the scope of work.

11. This contractor will be responsible for all re-mobilization costs for all phases of work.

12. Reference all electrical drawings. This contractor is responsible for all demo notes and new work notes on all electrical drawings.

13. Coordinate and schedule utility shut-downs as required for this contractors work with Owner.

14. Obtain all permits and approvals for the work of this category as with the State of Michigan Bureau of Construction Codes (BCC) as required, Owner will reimburse costs of all permits.

15. This contractor will provide and maintain all temporary lighting and power as required and specified in the Special Conditions.
16. This contractor’s field superintendent shall be present during testing and field reviews conducted by the various inspection agencies.

17. This contractor will be responsible for all hoisting, rigging and material handling necessary for the work.

18. This contractor shall provide rough-ins and final electrical connections for mechanical, food service and electrical equipment, specialties, and casework, as specified. Coordinate with other trades to provide all required electrical connections. Furnish and install all electrical equipment and accessories as related to other trades.

19. Contractor is responsible for removal of all spoils resulting from their work from the site.

20. Verify and stake locations of all underground utilities before work begins, inclusive of Miss Dig notification and stake out.

21. Coordinate with Architect/Engineer before penetrating any structural members.

22. Provide all demolition, removals, disconnection, saw cutting, coring, etc. required for the work of this category.

23. Furnish and install all specified backing and supports for fixtures and equipment as required.

24. Provide all electrical work complete as indicated, specified and required and as follows:
   A) All new service work; inclusive of modifications or revisions to existing services as required.
   B) All line voltage power systems work complete; inclusive of panels, raceways, conduits, boxes, wire, wiring devices, disconnects, starters, mechanical wiring, technology power, etc. to produce a complete and functional system as required and/or as indicated on the bid documents.
   C) All lighting systems work complete; inclusive of panels, raceways, conduits, boxes, wire, fixtures, disconnects, contactors, occupancy sensors, etc. to produce a complete and functional lightings system as required and/or as indicated on the bid documents.
   D) All empty conduits, raceways and boxes for telephone and data systems.
   E) All fire alarm systems work complete; inclusive of panels, conduit, raceways, boxes, audio/visual signal
devices, activation devices, duct detector wiring and tie-in, tie-ins and modifications/revisions to existing systems as required, testing, certification and State (BFS) and local fire marshal approvals to produce a complete and functional fire alarm system as required and/or as indicated on the bid documents.

F) All clock, public address and sound systems work complete; inclusive of equipment, conduit, raceways, boxes, devices, tie-ins and modifications/revisions to existing systems as required and/or as indicated on the bid documents.

G) All services to & final connections to all mechanical and food service equipment; inclusive of pumps, water heaters, air distribution boxes, unit ventilators, etc.

H) All required testing and certifications of systems installed by this category.

I) All patching, fire stopping and fire caulking of all openings created for this work.

J) Provide identification of all service and distribution equipment panels, disconnects, switches, starters, contactors, junction and pull boxes, etc. installed by this category.

K) Provide detailed as-built drawings inclusive of accurate dimensioning, locations and elevations.

L) Provide operational manuals and care and maintenance instruction for all equipment and devices installed by this category.

M) Provide Owner training for all systems, equipment and devices installed by this category.

25. Provide protection of equipment. Damage to equipment due to a lack of adequate protection will be the responsibility of this contractor.

26. Electrical Contractor to provide all support steel, uni-strut, etc. for support and anchoring of all devices and equipment installed by this category.

27. Daily clean-up and removal of debris generated by the work of this category and placed in dumpsters. All bulky items and boxes shall be broken down prior to placement in dumpsters. Debris will not be allowed to accommodate on the site or inside the buildings.
28. Restore site to existing or new condition as complete of work. Clean any and all areas affected during construction operations.

29. Provide all required closeout documents upon completion of project.

30. Provide three sets of material submittals for approval. If submittals comply with specifications, “Material Compliance Certificate” shall be used.

31. Note: Milestone Schedule. This trade will be required to provide a detailed schedule upon award of this contract.

32. Provide quotation for the following Alternates:

   a. **Alternate No. 1**: Provide cost to perform all work associated with constructing new walls, reconfiguring gas, electrical and plumbing lines, adding food service equipment and all related items in the Kitchen Area 18 as indicated on the drawings.

33. This Contractor is to include the sum of Five Thousand Dollars ($5,000.00) in the base bid amount for this category for use as a construction allowance at the Owner’s discretion. Any amount not used during the course of the project, shall be returned to the Owner upon completion of the project by issuance of a credit change order.
**SECTION 01010 – SUMMARY OF WORK – PROPOSAL F: FOOD SERVICE EQUIPMENT**

<table>
<thead>
<tr>
<th>PROPOSAL F: FERNDALE HS-CAFETERIA AND SERVING LINE RENOVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division 0 Bidding &amp; Contract Requirements</td>
</tr>
<tr>
<td>Division 1 General Requirements</td>
</tr>
<tr>
<td>Specification Section 02070 Selective Demolition</td>
</tr>
<tr>
<td>Specification Section 11400 Food Service Equipment</td>
</tr>
</tbody>
</table>

In addition to the above, this bid category includes but is not limited to the Bidding Documents, the Bidding and Contract requirement sand Division 1 General Requirements of the Project Manual and various other Technical Specifications interfacing with this work. The bidder is advised to review the work descriptions of the other categories and other referenced documents so as to not misunderstand scope responsibilities.

THE SCOPE OF THIS BID CATEGORY SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING ITEMS:

1. Requirements of items included under General Work to be completed by all contractors.
2. This contractor shall be responsible for all layout, engineering, and elevations and layout coordination with other contractors. It is the responsibility of this contractor to layout all work of this category.
3. Coordinate work with other trades on site.
4. Strict enforcement of this contractor’s requirement to provide timely clean-up, removal and disposal of all rubbish and debris generated by this trade during the work. Maintain a clean condition at all areas on site and free from dirt, mud, and gravel.
5. This contractor is responsible to provide a dumpster and/or legal disposal of all their own debris and clean up as required.
6. Provide all labor and equipment necessary for the complete scope of work as shown within the Construction Documents unless specifically noted to be completed by others. Work includes but not limited to: Removal of existing food service equipment and the supply and installation of new...
food service equipment and accessories as indicated in the bid documents.

7. Remove and legally dispose of all excess materials and debris generated by scope of work.

8. Provide temporary protection of Owner’s personnel, general public and property during construction.

9. Restore site to existing or new condition as complete of work. Clean any and all areas affected during construction operations.

10. Provide all required closeout documents upon completion of project.

11. Provide three sets of material submittals for approval. If submittals comply with specifications, “Material Compliance Certificate” shall be used.

12. **Note:** Milestone Schedule. This trade will be required to provide a detailed schedule upon award of this contract.

13. Provide quotation for the following Alternates:
   a. **Alternate No. FSA1:** Provide cost to provide Sneeze Guard Upgrade per specifications for food service equipment items indicated on the drawings.
   b. **Alternate No. FSA2:** Provide cost to provide Custom Counters in lieu of Standard Modular Counters per specifications for food service equipment items indicated on the drawings.
PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to other Sections of Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION:

A. Contractor shall provide the services of a full time Project Coordinator for the duration of the construction work.

   1. Employ someone with not less than ten years experience performing coordination work on projects of similar size and scope.

   2. Submit name and qualifications to Architect.

B. Provide additional administrative and supervisory personnel as required for the performance of the work including coordination of the various subcontractors.

C. Related Requirements Specified in Other Sections:

   1. Summary of Work: Section 01010.

1.03 PROJECT COORDINATOR'S DUTIES:

A. Coordinate the work of the various subcontractors:

   1. For temporary utilities.

   2. With the work of trades specified in Division 2 through 16.

B. Coordinate the schedules of subcontractors.

   1. Verify timely deliveries of products for installation by other trades.

   2. Verify that labor and materials are adequate to maintain schedules.
C. Maintain conferences among subcontractors and other concerned parties, as necessary to:
   1. Maintain coordination and schedules.
   2. Resolve matters in dispute.

D. Participate in project meetings:
   1. Report progress of work.
   2. Recommend needed changes in schedule.

E. Temporary Utilities:
   1. Coordinate installation, operation and maintenance, to verify compliance with project requirements and with Contract Documents.
   2. Verify adequacy of service at required locations.

F. Shop Drawings, Product Data and Samples:
   1. Prior to submittal, review for compliance with Contract Documents.
      a. Check field dimensions and clearance dimensions.
      b. Check relation to available space.
      c. Review the effect of any changes on the work of other contracts or trades.
      d. Check compatibility with equipment and work of other trades.

G. Coordination Drawings:
   1. Prepare, as required to assure coordination of work or to resolve conflicts.
   2. Submit for review and transmittal.
   3. Reproduce and distribute approved copies to all concerned parties.
H. Observe required testing; maintain a record of tests:
   1. Testing agency and name of inspector.
   2. Subcontractor.
   3. Manufacturer's representative present.
   4. Date and time of testing.
   5. Type of product or work.
   6. Type of test and results.
   7. Retesting required.

I. Verify that subcontractors maintain accurate record documents.

J. Substitutions and Changes:
   1. Review proposals and requests.
      a. Check for compliance with Contract Documents.
      b. Verify compatibility with work and equipment of other trades.
   2. Promptly report deficiencies or discrepancies to The General Contractor.

K. Assemble documentation for handling of claims or disputes.

L. Equipment Start-Up:
   1. Check to assure that utilities and specified connections are complete and that equipment is in operable condition.
   2. Observe test, adjust and balance.
   3. Record results, including time and date of start-up.
M. Inspection and Acceptance of Work:

1. Prior to inspection, check that work is complete and ready for acceptance

2. Assist Inspector: Prepare list of items to be completed or corrected.

3. Should acceptance of work constitute the beginning of the specified guarantee period, prepare and transmit written notice to Contractor for the Owner.

N. Assemble record documents from subcontractors.

END OF SECTION 01041
SECTION 01045 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for cutting and patching.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division-15 and Division-16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

C. Demolition of selected portions of the building for alterations is included in Section 02070 "Selective Demolition."

1.3 SUBMITTALS

A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.

2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.

3. List products to be used and firms or entities that will perform Work.
4. Indicate dates when cutting and patching is to be performed.
5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
7. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.4 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.

B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

PART 3 - EXECUTION

3.1 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

1. Before proceeding, meet at the site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
4. Comply with requirements of applicable Sections of Division-2 where cutting and patching requires excavating and backfilling.
5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
   a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.
4. Patch, repair or rehang existing ceilings (not scheduled for replacement) as necessary to provide an even plane surface of uniform appearance.

3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.
SECTION 01090 - REFERENCE STANDARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES:
   A. Quality assurance.
   B. Schedule of references.

1.02 QUALITY ASSURANCE:
   A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
   B. Conform to reference standard by date of issue current on date for receiving bids.
   C. Obtain copies of standards when required by Contract Documents.
   D. Maintain copy at job site during submittals, planning, and progress of the specific work, until Substantial Completion.
   E. Should specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
   F. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.04 SCHEDULE OF REFERENCE:

AA  Aluminum Association
    900 19th Street, N.W. - Suite 300
    Washington, DC  20006

AABC  Associated Air Balance Council
    1518 K Street N.W.
    Washington, DC  20005

AASHTO  American Association of State Highway and Transportation Officials
    444 North Capitol Street, N.W. - Suite 249
    Washington, DC  20001
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION  171745  JANUARY 12, 2018

ACI  American Concrete Institute
     P.O. Box 9094
     Farmington Hills, MI 48333-9094

ADC  Air Diffusion Council
     1901 N. Roselle Rd., Suite 800
     Schaumburg, IL 60195

AF&PA  American Forest & Paper Association
       1111 19th Street, NW, Suite 800
       Washington, DC 20036

AGC  Associated General Contractors of America
     2300 Wilson Blvd., Suite 400
     Arlington, VA 22201

AI  Asphalt Institute
     2696 Research Park Drive
     Lexington, KY 40511-8480

AIA  American Institute of Architects
     1735 New York Avenue, N.W.
     Washington, DC 20006-5292

AISC  American Institute of Steel Construction
      One East Wacker Drive
      Suite 3100
      Chicago, IL 60601-2001

AISI  American Iron and Steel Institute
      1140 Connecticut Ave - Suite 705
      Washington, DC 20036

AITC  American Institute of Timber Construction
      7012 S. Revere Parkway - Suite 140
      Englewood, CO 80112

AMCA  Air Movement and Control Association
      30 West University Drive
      Arlington Heights, IL 60004

ANSI  American National Standards Institute
      25 West 43rd Street, Fourth Floor
      New York, NY 10036

APA  American Plywood Association
      Box 11700
      Tacoma, WA 98411-0700
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

ARI  Air Conditioning and Refrigeration Institute
     4100 North Fairfax Drive - Suite 200
     Arlington, VA 22203

ASHRAE  American Society of Heating, Refrigeration and
         Air Conditioning Engineers
        1791 Tullie Circle, N.E.
        Atlanta, GA 30329

ASME  American Society of Mechanical Engineers
      Three Park Avenue
      New York, NY 10016-5990

ASTM  American Society for Testing and Materials
      100 Barr Harbor Drive
      West Conshohocken, PA 19428-2959

AWI  Architectural Woodwork Institute
     46179 Westlake Drive, Suite 120
     Potomac Falls, VA 20165

AWPA  American Wood-Preservers' Association
      P.O. Box 5690
      Grandbury, TX 76049

AWS  American Welding Society
     550 N.W. LeJeune Road
     Miami, FL 33126

AWWA  American Water Works Association
      6666 West Quincy Avenue
      Denver, CO 80235

BIA  Brick Institute of America
     1350 Centennial Park Drive, Suite 301
     Reston, VA 20191

CDA  Copper Development Association
     260 Madison Avenue - 16th Floor
     New York, NY 10016

CLFMI  Chain Link Fence Manufacturers Institute
      10015 Old Columbia Road, Suite B-215
      Columbia, MD 21046

CRSI  Concrete Reinforcing Steel Institute
      933 Plum Grove Road
      Schaumburg, IL 60173-4758
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION        171745        JANUARY 12, 2018

MBMA Metal Building Manufacturer's Association
1300 Sumner Avenue
Cleveland, OH  44115-2351

MFMA Maple Flooring Manufacturers Association
60 Revere Drive
Northbrook, IL  60062

MIL Military Specification
Naval Publications and Forms Center
700 Robbins Avenue, Building 4, Section D
Philadelphia, PA  19111-5093

ML/SFA Metal Lath/Steel Framing Association
Division of National Association of Architectural Metal Manufacturers (NAAMM MLIFSA)
600 South Federal Street, Suite 400
Chicago, IL  60605

NAAMM National Association of Architectural Metal Manufacturers
800 Roosevelt Road, Building C, Suite 312
Glen Ellyn, IL  60137

NCMA National Concrete Masonry Association
2302 Horse Pen Road
Herndon, VA  22071-3499

NEBB National Environmental Balancing Bureau
8575 Grovement Circle
Gaithersburg, MD 20877

NEMA National Electrical Manufacturers' Association
1300 North 17th Street, Suite 1752
Rosslyn, VA 22209

NFPA National Fire Protection Association
#1 Battery March Park
Quincy, MA  02269-9101

NSWMA National Solid Wastes Management Association
4301 Connecticut Avenue, N.W., Suite 300
Washington, DC  20008-2304

NTMA National Terrazzo and Mosaic Association
201 North Maple, Suite 208
Purcellville, VA 20132
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

PCA  Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

PCI  Precast Prestressed Concrete Institute
175 W. Jackson Blvd.-Suite 1859
Chicago, IL 60604-9773

PS  Product Standard
U.S. Department of Commerce
1401 Constitution Avenue, N.W.
Washington, DC 20230

RIS  Redwood Inspection Service
Division of California Redwood Association
405 Enfrente Drive
Novato, CA 94949

SDI  Steel Deck Institute
P.O. Box 25
Fox River Grove, IL 60021

SDI  Steel Door Institute
c/o Wherry Associates
30200 Detroit Road
Cleveland, OH 44145-1967

SIGMA  Sealed Insulating Glass Manufacturers Association
401 N. Michigan Avenue
Chicago, IL 60611

SJI  Steel Joist Institute
3127 10th Avenue North
Myrtle Beach, SC 29577-6760

SMACNA  Sheet Metal and Air Conditioning Contractors' National Association
4201 Lafayette Center Drive
Chantilly, VA 20151-1209

SSPC  Society for Protective Coatings
40 24th Street, 6th Floor
Pittsburgh, PA 15222-4656

TCNA  Tile Council of North America, Inc.
100 Clemson Research Blvd.
Anderson, SC 29625
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

TPI Turfgrass Producers International
2 East Main Street
East Dundee, IL 60118

UL Underwriters' Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062-2096

WCLIB West Coast Lumber Inspection Bureau
6980 S.W. Varns Road
Tigard, OR 97223

WDMA Window & Door Manufacturers Associations
1400 W. Touhy Avenue, Suite 470
Des Plaines, IL 60018

WWPA Western Wood Products Association
522 SW Fifth Avenue, Suite 500
Portland, OR 97204-2122

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION 01090
SECTION 01100 - ALTERNATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

A. This section identifies each Alternate by number, and describes the basic changes to be incorporated into the work, only when the Alternate is made a part of the work by specific provisions in the Owner-Contractor Agreement.

B. Alternate schedule below is part of the Bidding Documents and will be considered in selection of Contractors and awarding contracts.

C. Unless otherwise provided, Owner will accept or reject alternates within one hundred twenty (120) days of date of contract. Owner reserves the right to reject any or all alternates.

1.03 ALTERNATES:

A. General:

1. The descriptions for each alternate listed in the schedule are primarily scope definitions, and do not necessarily detail the full range of materials and processes needed to complete the work as required.

2. Refer to applicable specification sections (Division 2 through 16), and to applicable drawings, for specific requirements of the work, regardless of whether references are so noted in description of each alternative.

3. Coordinate pertinent related work and modify surrounding work as required to properly integrate the work under each Alternate, and to provide the complete construction required by Contract Documents.
4. Referenced sections of specifications stipulate pertinent requirements for products and methods to achieve the work stipulated under each Alternate.

B. Schedule:

a. **Alternate No. 1**: Provide cost to perform all work associated with constructing new walls, reconfiguring gas, electrical and plumbing lines, adding food service equipment and all related items in the Kitchen Area 18 as indicated on the drawings.

b. **Alternate No. 2**: Provide cost to grind and polish all terrazzo floors in the Cafeteria 01, Serving 09, Corridor 17 and Kitchen Area 18 as indicated on the drawings.

c. **Alternate No. FSA1**: Provide cost to provide Sneeze Guard Upgrade per specifications for food service equipment items indicated on the drawings.

d. **Alternate No. FSA2**: Provide cost to provide Custom Counters in lieu of Standard Modular Counters per specifications for food service equipment items indicated on the drawings.

END OF SECTION 01100
SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

1. RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
   1. Pre-Construction Conference.
   2. Pre-Installation Conferences.
   3. Coordination Meetings.
   4. Progress Meetings.

B. Construction schedules are specified in Specification Section 01310 “Construction Schedules”.

1.3 PRE-CONSTRUCTION CONFERENCE

A. Schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than (15) days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.

B. Attendees: The Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.

C. Agenda: Discuss items of significance that could affect progress including such topics as:
   1. Tentative construction schedule.
   2. Critical work sequencing.
   3. Designation of responsible personnel.
   4. Procedures for processing field decisions and Change Orders.
   5. Procedures for processing Applications for Payment.
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

7. Submittal of Shop Drawings, Product Data and Samples.
8. Preparation of record documents.
9. Use of the premises.
10. Office, Work and storage areas.
11. Equipment deliveries and priorities.
12. Safety procedures.
13. First aid.
15. Housekeeping.
16. Working hours.

1.4 PRE-INSTALLATION CONFERENCES

A. Conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Owner and Architect of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:

   b. Options.
   c. Related Change Orders.
   d. Purchases
   e. Deliveries.
   f. Shop Drawings, Product Data and quality control Samples.
   g. Possible conflicts.
   h. Compatibility problems.
   i. Time schedules.
   j. Weather limitations.
   k. Manufacturer's recommendations.
   l. Compatibility of materials.
   m. Acceptability of substrates.
   n. Temporary facilities.
   o. Space and access limitations.
   p. Governing regulations.
   q. Safety.
   r. Inspection and testing requirements.
   s. Required performance results.
   t. Recording requirements.
   u. Protection.
2. Record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including the Owner and Architect.

3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 COORDINATION MEETINGS

A. Conduct Project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.

B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.

C. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.6 PROGRESS MEETINGS

A. Conduct progress meetings at the Project site at regularly scheduled intervals. Notify the Owner and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
1. 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, 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.

2. Review the present and future needs of each entity present, including such items as:
   a. Interface requirements.
   b. Time.
   c. Sequences.
   d. Deliveries.
   e. Off-site fabrication problems.
   f. Access.
   g. Site utilization.
   h. Temporary facilities and services.
   i. Hours of Work.
   j. Hazards and risks.
   k. Housekeeping.
   l. Quality and Work standards.
   m. Change Orders.
   n. Documentation of information for payment requests.

D. Reporting: No later than (3) days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

1. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01200
SECTION 01310 - CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to other Sections of Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF REQUIREMENTS:

A. General: This section specifies the particular administrative and procedural requirements for progress time scheduling and progress reporting for the performance of the work, as indicated in the General Conditions and elsewhere in the Contract Documents. Refer also to the General Conditions and to the "Contractor" for definition and specific dates of the Contract Time.

B. Scheduling Responsibility: Submission of Contractor's progress schedule to the Owner and/or Architect shall not relieve the Contractor of his total responsibility for scheduling, sequencing and pursuing the work to comply with the requirements of the Contract Documents, including adverse effects such as delays resulting from ill-timed work; refer to General Conditions.

1.03 FORM OF SCHEDULES:

A. Contractor shall prepare a "Plan of Operations and Progress Schedule" which shall show concisely the manner in which different phases of the work are to be started, methods and speed for the inter-relationship of the work under the various contracts, times upon which different phases of the work are to be started, methods and speed for progressing the different phases and dates upon which the certain subcontractors are dependent upon that under other subcontracts.

B. The plan of operations and progress schedule shall be "weighed" to schedule each trade in proportion to the entire project, both physically and financially.

C. In preparing the above plan of operations and progress schedule, the Contractor shall assure that the dates and other pertinent matters are acceptable to the Architect and, when completed, he shall submit to and obtain approval from the Architect.
D. After approval of the above plan of operations and progress schedule, the Contractor shall be responsible for seeing that it is adhered to and for ascertaining that proper coordination is maintained between work of all Contracts.

1.04 PROGRESS REVISIONS:

A. Indicate progress of each activity to date of submission.

B. Show changes occurring since previous submission of schedule:
   1. Major changes in scope.
   2. Activities modified since previous submission.
   3. Revised projections of progress and completion.
   4. Other identifiable changes.

C. Provide a narrative report as needed to define:
   1. Problem areas, anticipated delays, and the impact on the schedule.
   2. Corrective action recommended and its effect.
   3. The effect of changes on schedules of other contractors.

1.05 SUBMISSIONS:

A. Submit initial schedules within (14) days after award of Contract.
   1. Architect and Owner will review schedules and return review copy within (10) days after receipt.
   2. Resubmit within (10) days after return of review copy.

B. Submit a revised and updated progress schedule and narratives with each application for payment, but not less than once a month until project is complete.
1.06 DISTRIBUTION:

A. Distribute copies of the reviewed schedules and narratives to:
   2. Subcontractors.
   3. Other concerned parties.

B. Instruct recipients to report promptly to the Contractor, in writing, any problems anticipated by the projections shown in the schedules.

1.07 DAILY REPORTS:

A. Contractor shall prepare a daily report, recording the following information concerning events at the site and submit duplicate copies to the Architect and Owner at regular intervals not exceeding weekly intervals.
   1. List of subcontractors at the site.
   2. List of separate contractors at the site.
   3. Count of personnel at the site.
   4. High/low temperatures, general weather conditions.
   5. Accidents (refer to accident reports).
   6. Meetings and significant decisions.
   7. Unusual events.
   8. Stoppages, delays, shortages, losses.
  10. Orders/requests by governing authorities.
  11. Change orders received, implemented.

PART 2 and 3 - PRODUCTS AND EXECUTION - Not Applicable

END OF SECTION 01310
SECTION 01340 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to other Sections of Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION:

A. Submit shop drawings, product data and samples as required by the Contract Documents. Individual submittal requirements are specified in applicable sections for each unit of work. Receive, check and coordinate all submittals of contractors as provided herein.

B. Definitions:

1. Shop Drawings are drawings, diagrams, schedules and other data specifically prepared for the Work by the Contractor or any subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

2. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work.

3. Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the work will be judged.

1.03 SUBMITTAL REQUIREMENTS:

A. Coordinate preparation and processing of submittals with performance of the work so that work will not be delayed by submittals. Coordinate and sequence different categories of submittals for the same work, and for interfacing units of work, so that one will not be delayed for coordination with another. No extension of time will be allowed because of failure to properly coordinate and sequence submittals.
B. Submit one reproduction transparency and the two (2) prints of each shop drawing, including fabrication, erection, layout and setting drawings and such other drawings as required under various sections of the Specifications, until final acceptance is obtained. Prepare drawings legible, drawing plans, elevations, sections and details in scales required and on drawing sheets not larger than 30" x 42" nor smaller than 24" x 30". Submit copies of manufacturer's descriptive data including catalog sheets for materials, equipment and fixtures, showing dimensions, performance characteristics and capacities, wiring diagrams and controls, schedules, and other pertinent information as required. Where printed materials describe more than one product or model, clearly identify which is to be furnished.

C. Shop drawings, product data and samples shall be dated including Contractor and Subcontractor dates of submittal and approval, and marked to show the names of the Project, Architect, Contractor, origination Subcontractor, manufacturer or supplier, and separate detailer if pertinent. Shop drawings shall completely identify Specification section and locations at which materials or equipment are to be installed. Reproductions of Contract Drawings are acceptable as Shop Drawings only when specifically authorized in writing by the Architect.

D. Submission of shop drawings, product data and samples shall be accompanied by a copy of a transmittal letter containing Project name, Contractor's name, number of drawings, and samples, titles and other pertinent data. Transmittal shall bear signature of the Contractor as evidence he checked same and found them in conformance with the Contract Documents.

E. The Contractor shall review, approve and submit, with reasonable promptness and in such sequence as to cause no delay in the Work or in the work of the Owner or any separate contractor, all Shop Drawings, Product Data and Samples required by the Contract Documents.

F. By approving and submitting Shop Drawings, Product Data and Samples, the contractor represents that he has determined and verified all materials, field measurements, and field construction criteria related thereto, or will do so, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.
G. The Contractor shall not be relieved of responsibility for the deviation from the requirements of the Contract Documents by the Architect's acceptance of Shop Drawings, Product Data or Samples under Section 3.12 of the General Conditions, unless the Contractor has specifically informed the Architect in writing of such deviation at the time of subdeviation. The Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data or Samples by the Architect's acceptance thereof.

H. The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data or Samples, to revisions other than those requested by the Architect on previous submittals.

I. No portion of the Work requiring submission of a Shop Drawing, Product Data or Sample shall be commenced until the submittal has been accepted by the Architect as provided in Section 3.12 of the General Conditions. All such portions of the Work shall be in accordance with approved submittals.

J. Architect will review Shop Drawings, Product Data and Samples as provided in Section 3.12 of the General Conditions. He will mark each such submittal as follows:

1. Accepted - Where no comment made.

2. Accepted as Noted - Where comments indicated on submittal qualifying, modifying, or otherwise changing it; however, submittal can be used for ordering, fabrication and erection at contractor's own risk until revised submittals have been made, reviewed and stamped acceptable.

3. Not Accepted - Submittal not in conformance; revise and resubmit. Acceptance does not authorize any changes in the Contract Documents unless specifically stated in a separate letter or change order.

K. Contractor is responsible for obtaining and distributing required prints of shop drawings to his subcontractors and material suppliers; after as well as before final approval. Prints of reviewed shop drawings shall be made from transparencies which carry the Architect's appropriate stamp.
L. Obtain copies of all shop drawings, product data and samples submitted to date and accepted from other contractors.

PARTS 2 and 3 - PRODUCT AND EXECUTION

Not applicable.

END OF SECTION 01340
SECTION 01370 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to other Sections of Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

A. Submit to the Architect a Schedule of Values allocated to the various portions of the work, within ten days after award of contract.

B. Upon request of the Architect, support the values with data which will substantiate their correctness.

C. The Schedule of Values, unless objected to by the Architect or Owner, shall be used only as the basis for the Contractor's Applications for Payment.

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES:

A. Use AIA Forms G702 and G702A or forms provided by Owner.

B. Schedule shall list the installed value of the component parts of the work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. Follow the table of contents of Sections as the format for listing component items.
   1. Identify each line item with the number and title of the respective major section of the specifications.

D. For each major line item list sub-values of major products or operations under the item.
   1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.

E. The sum of all values listed in the schedules shall equal the total Contract Sum.

PARTS 2 AND 3 - PRODUCTS AND EXECUTION - Not Applicable

END OF SECTION 01370
SECTION 01400 - QUALITY CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION:

A. Specific quality control requirements for the work are indicated throughout the contract documents. The term "Quality Control" includes, but is not necessarily limited to, inspection and testing and associated requirements. This section does not specify or modify Architect's duties relating to quality control and Contract enforcement.

B. Coordinate quality control programs of separate contractors including submittals, conferences and on site programs.

1.03 RESPONSIBILITY:

A. Residual Contractor Responsibility: Whatever required, inspection, testing and similar quality control provisions to be performed by independent agencies (not directly by the Contractor), and not indicated to be Owner's responsibility, shall be the Contractor's responsibility. The costs for those required services by independent testing laboratories are recognized to be included in Contract Sum.

B. Contractor's General Responsibility: No failure of test agencies, whether engaged by Owner or Contractor, to perform adequate inspections or tests or to properly analyze or report results, shall relieve Contractor of responsibility for fulfillment of requirements of contract documents. It is recognized that required inspection and testing program is intended to assist the Contractor, Owner, Architect, and governing authorities in nominal determination of probable compliances with requirements for certain elements of work. The program is not intended to limit the Contractor's regular quality control program, as needed for general assurance of compliances.
1.04 QUALITY ASSURANCE:

A. General Workmanship Standards: Comply with recognized workmanship quality standards within the industry as applicable to each unit of work, including ANSI standards where applicable. It is a requirement that each category of trades person or installer performing the work be prequalified, to the extent of being familiar with applicable and recognized quality standards for that category of work, and being capable of workmanship complying with those standards.

B. Qualification of Quality Control Agencies: Except where another qualification standard is indicated, and except where it is specifically indicated that use of prime product manufacturer's test facilities is acceptable, engage independent testing laboratories complying with "Recommended Requirements for Independent Laboratory Qualifications" as published by American Council of Independent Laboratories, and specializing in type(s) of inspections and tests required.

1.05 SUBMITTALS:

A. General: Refer to Section 01340, "Shop Drawings, Product Data and Samples" for requirements applicable to inspection and test reports, quality control samples, maintenance agreements, warranties, and similar documentation of quality compliances as required. Refer to individual work sections of Division 2 through 16 for specific certification and submittal requirements.

B. Copies and Distribution: Where inspection and test reports and certifications are required by governing authorities, provide additional copies as required, and where required, send copies directly from inspection or testing agency to governing authority.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. General: Handle, store and protect materials and products, including fabricated components, by methods and means which will prevent damage, deterioration and losses including theft (and resulting delays), thereby ensuring highest quality results as performance of the work progresses. Control delivery schedules so as to minimize unnecessary long-term storage at project site prior to installation.
PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION:

3.01 PREPARATION FOR INSTALLATION:

A. Pre-Installation Conferences: Well in advance of installation of every major unit of work which requires coordination with other work, meet at the project site with installers and representatives of manufacturers and fabricators who are involved in or affected by the unit of work, and in its coordination or integration with other work which has proceeded or will follow. Advise Architect and Owner of scheduled meeting dates. At each meeting, review progress of other work and preparations for particular work under consideration, including requirements of contract documents, options, related change orders, purchases, deliveries, shop drawings, product data, quality control samples, possible conflicts, compatibility problems, time schedule, weather limitations, temporary facilities, space and access limitations, structural limitations, governing regulations, safety, inspection and testing requirements required performance results, recording requirements, and protection. Record significant discussions of each conference, and agreements and disagreements along with final plan of action. Distribute record of meeting promptly to everyone concerned, including Architect and Owner.

1. Do not proceed with the work if associated pre-installation conference cannot be concluded successfully. Instigate actions to resolve impediments to performance of the work, and reconvene conference at earliest data feasible.

B. Installer's Inspection of Conditions: Require Installer of each major unit of work to inspect substrate to receive the work, and conditions under which the work will be performed, and to report (in writing to the General Contractor) unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
3.02 COORDINATION OF TEST AGENCY WORK:

A. Coordination with Owner's Agencies: Afford access and reasonable time in construction sequence for Owner's inspection and tests to be performed. Cooperate with agencies and provide incidental labor and services needed for the removal and delivery of test samples, and for inspections and taking measurements. Provide patching and restoration services where test samples have been removed, complying with individual technical sections of Divisions 2 through 16.

1. Except for specialized laboratory sampling equipment, and except as otherwise indicated, supply and operate tools and construction equipment needed to obtain test samples from the work, including cutting devices for sawing, drilling, flame-cutting, coring and similar operations. Assist agencies in labeling and packing of test samples removed from the work.

B. Coordination with Contractor's Independent Agencies: Except for required independent agency activities of inspection, measuring, testing, analyzing, reporting and similar activities, the assignment of labor, equipment, cutting, patching and similar necessary activities associated therewith are Contractor's option recognizing that entire activity is Contractor's responsibility.

C. Test Agency Responsibilities:

1. Test agencies, regardless of whether engaged by Owner or Contractor, are not authorized to change or negate requirements of Contract Documents. Each agency shall coordinate its assigned work with construction schedule as maintained by Contractor, and shall perform its work promptly so as not to delay the work. Observances (by agencies) having a bearing on the work shall be reported to Architect in most expeditious way possible, and shall be recorded in writing by agency. Agency personnel shall not interfere with or assume duties of Contractor.

2. Reports: The testing agency shall prepare reports of inspections and laboratory tests, including analysis and interpretation of test results where applicable. Properly identify each report and, where required, provide agency's certification of test results. Describe test methods used, and compliance with recognized test standards (if any). Complete and submit report at earliest possible date in each case.
3.03 INSTALLATION QUALITY CONTROL:

A. Manufacturer's Instructions: Where installations include manufactured products, comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicate in contract documents.

B. Inspect each item of materials or equipment, immediately prior to installation, and reject damaged and defective items.

C. Provide attachment and connection devices and methods for securing work properly as it is installed; true to line and level, and within recognized industry tolerances, if not otherwise indicated. Allow for expansions and building movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual effect choices to Architect for final decision.

D. Recheck measurements and dimensions of the work, as an integral step of starting each installation.

E. Install work during conditions of temperature, humidity, exposed, forecasted weather, and status of project completion which will ensure best possible results for each unit of work, in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.

F. Coordinate enclosure (closing-in) of work with required inspections and tests, so as to avoid necessity of uncovering work for that purpose.

G. Mounting Heights: Except as otherwise indicated, mount individual units of work at industry-recognized standard mounting heights, for applications indicated. Refer questionable mounting height choices to Architect for final decision.

H. Adjust, clean, lubricate, restore, marred finished, and protect newly installed work, to ensure that it will remain without damage or deterioration during the remainder of construction period.

END OF SECTION 01400
SECTION 01600 - MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division O, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION:

A. Material and equipment incorporated into the work:

1. Conform to applicable specifications and standards.

2. Comply with size, make, type and quality specified, or as specifically approved in writing by the Architect.

3. Manufactured and Fabricated Products:

a. Design, fabricate and assemble in accord with the best engineering and shop practices.

b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.

c. Two or more items of the same kind shall be identical, by the same manufacturer.

d. Products shall be suitable for service conditions.

e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.03 MANUFACTURER'S INSTRUCTIONS:

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such, including three copies to Architect.

1. Maintain one set of complete instructions at the job site during installation and until completion.
B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Architect for further instructions.

2. Do not proceed with work without clear instructions.

C. Perform work in accord with manufacturer's instructions. Do not omit preparatory step or installation procedure unless specifically modified or exempted by contract documents.

1.04 TRANSPORTATION AND HANDLING:

A. Arrange deliveries of products in accord with construction schedules, coordinate to avoid conflict with work and conditions at the site.

1. Immediately on delivery, inspect shipments to assure compliance with requirements of contract documents and approved submittals, and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.05 STORAGE AND PROTECTION:

A. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.

1. Store products subject to damage by the elements in weathertight enclosures.

2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

B. EXTERIOR STORAGE:

1. Store fabricated products above the ground, on blocking or skids, prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.
2. Store any loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.

D. Preparation After Installation:

1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

1.06 SUBSTITUTIONS AND PRODUCT OPTIONS:

A. Products List:

1. Within (15) days after contract date, submit to Architect a complete list of major products proposed to be used, with the name of the manufacturer and the installing subcontractor. Comply with provisions for Contractor's Options and Substitutions.

B. Contractor's Options:

1. For products specified only by reference standard, select any product meeting that standard.

2. For products specified by naming several products or manufacturers, select any one of the products or manufacturers named, which complies with the specifications.

3. For products specified by naming one or more products or manufacturers and "or equal," Contractor must submit a request as for substitutions for any product or manufacturer not specifically named.

4. For products specified by naming only one product and manufacturer, there is no option.

C. Substitutions:

1. For a period of (15) days after contract date, Architect will consider written requests from Contractor for substitution of products.
2. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including:

   a. Comparison of the qualities of the proposed substitution with that specified.

   b. Changes required in other elements of the work because of the substitution.

   c. Effect on the construction schedule.

   d. Cost data comparing the proposed substitution with the product specified.

   e. Any required license fees or royalties.

   f. Availability of maintenance service, and source of replacement materials.

3. Architect shall be the judge of the acceptability of the proposed substitution except where a change in cost is involved.

D. Contractor's Representation:

1. A request for a substitution constitutes a representation that Contractor:

   a. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.

   b. Will provide the same warranties or bonds for the substitution as for the product specified.

   c. Will coordinate the installation of an accepted substitution into the work, and meet such other changes as may be required to make the work complete in all respects.

   d. Waives all claims for additional costs, under his responsibility which may subsequently become apparent.
E. Architect will review requests for substitutions with reasonable promptness, and notify Contractor, in writing, of the decision to accept or reject the requested substitution.

PARTS 2 AND 3 PRODUCTS AND EXECUTION

Not applicable.

END OF SECTION 01600
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:

1. Inspection procedures.
2. Project record document submittal.
3. Operating and maintenance manual submittal.
4. Submittal of warranties.
5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions-2 through -16.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

   a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

2. Advise Owner of pending insurance change-over requirements.
3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

5. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Architect will repeat inspection when requested and assured that the Work has been substantially completed.

2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.

4. Submit consent of surety to final payment.

5. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
B. Reinspection Procedure: The Architect will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.

1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, reinspection will be repeated.

1.5 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
3. Note related Change Order numbers where applicable.
4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the
Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

1. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.

D. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

1. Upon completion of mark-up, submit complete set of record Product Data to the Architect for the Owner's records.

E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.

G. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
1. Emergency instructions.
2. Copies of warranties.
3. Recommended maintenance.
4. Inspection procedures.
5. Product Data.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:

1. Maintenance manuals.
2. Record documents.
3. Hazards.
4. Cleaning.
5. Warranties and bonds.
6. Maintenance agreements and similar continuing commitments.

3.2 FINAL CLEANING

A. General: General cleaning during construction is required by the General Conditions and as required under applicable specifications sections (Division 2 thru 16).

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Clean transparent materials, including glass in doors and windows from any construction debris. Replace chipped or broken glass (from construction debris) and other damaged (during construction activities) transparent materials.
2. Clean exposed exterior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Leave concrete floors broom clean.
3. Clean the construction site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits.

C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION 01700
PART ONE - GENERAL

1.01 GUARANTEE PERIOD

A. The General Contractor shall and hereby does guarantee and warrant that all work for this building, under this Contract, shall be free from defects or faulty labor and/or materials for a period of one (1) year from the date of Final Acceptance of same, except when longer periods are herein specified, which develop within any guarantee periods.

1.02 FINAL PAYMENT

A. Final payment is contingent upon the Owner's Representative's receipt of such guarantees and/or warranties from the General Contractor.

END OF SECTION 01800
1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section requires the selective removal and subsequent offsite disposal of the following:

1. Portions of existing finishes indicated on drawings and as required to accommodate new finishes.

2. Removal and protection of existing fixtures, and food service equipment items indicated on drawings as "salvage" and/or return to Owner.

3. Removal of existing terrazzo floors, concrete slabs, walls, doors, frames, handrails, food service equipment, built-in casework, steel gates, plaster ceilings, food service equipment, etc. as indicated on drawings or required for new construction.

4. Removal of mechanical systems, electrical, fire alarm, gas and plumbing piping and infrastructure as indicated on drawings or required for new construction.

B. Removal work specified elsewhere:

1. Cutting nonstructural concrete floors and masonry walls for piping, ducts, and conduits is included with the work of the respective mechanical and electrical specification sections in Divisions 15 and 16.

C. Related work specified elsewhere:

1. Remodeling construction work and patching are included within the respective sections of specifications, including removal of materials for reuse and incorporation into remodeling or new construction.
2. Relocation of pipes, conduits, ducts and other mechanical and electrical work is specified in other divisions.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Schedule indicating proposed sequence of operations for selective demolition work to the Owner for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.

C. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with the Owner prior to start of work.

1.4 JOB CONDITIONS

A. Occupancy: Owner will occupy portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will affect Owner's normal operations.

B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.

1. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.

C. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to the Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.

1. Storage or sale of removed items on site will not be permitted.
D. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public from injury due to selective demolition work.

1. Provide protective measures as required to provide free and safe passage of Owner's personnel and general public to occupied portions of building.

2. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.

3. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.

4. Protect floors with suitable coverings when necessary.

5. Construct temporary insulated one hour fire rated dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.

6. Remove protections at completion of work.

E. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

F. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

1. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

G. Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.
H. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

2. Maintain fire protection services during selective demolition operations.

I. Environmental Controls: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.

1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.

1. Cease operations and notify the General Contractor, Owner and Architect immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

2. Cover and protect furniture, equipment, and fixtures from soilage or damage when demolition work is performed in areas where such items have not been removed.

3. Erect and maintain fire rated dustproof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.
a. Where selective demolition occurs immediately adjacent to occupied portions of the building, construct fire rated dust-proof partitions of minimum 4-inch studs, 5/8-inch drywall (joints taped) on occupied side, 1/2-inch fire-retardant plywood on demolition side. Fill partition cavity with sound-deadening insulation.

b. Provide weatherproof closures for exterior openings resulting from demolition work.

4. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.

a. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of (72) seventy two hours advance notice to Owner if shutdown of service is necessary during changeover.

3.2 DEMOLITION

A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

1. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.

2. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to the Owner in written, accurate detail. Pending receipt of directive from the Owner, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.
3.3 SALVAGED MATERIALS

A. Salvaged Items: Where indicated on Drawings as "Salvage - Deliver to Owner," carefully remove indicated items, clean, store, and turn over to Owner and obtain receipt.

1. Historic artifacts, including cornerstones and their contents, commemorative plaques and tablets, antiques, and other articles of historic significance, remain property of Owner. Notify the General Contractor if such items are encountered and obtain acceptance regarding method of removal and salvage for Owner.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.

1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

2. Burning of removed materials is not permitted on project site.

3.5 CLEANUP AND REPAIR

A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.

1. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 02070
SECTION 03001 - CONCRETE

PART 1. GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification.

1.02 SECTION INCLUDES

A. Work included in this section includes furnishing all labor, materials, equipment and incidentals required for complete installation of formwork, reinforcement, accessories, cast-in-place concrete, finishing and curing. This section pertains to sign and bollard foundations, supported concrete walkway at Probate Court and supported slab foundations concrete work. This section also includes fill for steel deck and fill for steel pan stairs (where indicated).

B. Related work specified elsewhere:

1. Section 03300 - Bonding Agents for Concrete
2. Section 03730 - Concrete Rehabilitation
3. Section 05500 - Metal Fabrications
4. Section 07920 - Sealants and Caulking
5. Section 10999 - Miscellaneous Specialties (Treads)

1.03 SUBMITTALS

A. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Indicate reinforcement sizes, spacings, locations, and quantities, bending and cutting schedules, supporting and spacing devices.

B. See drawings for General Notes and Special Conditions.

C. Provide data on joint devices, attachment accessories, mix design for each type concrete, proportions of all ingredients, admixtures, slump range, expected strength and water cement ratio. Provide historical test data with each proposed mix design.
1.04 QUALITY ASSURANCES

A. Building Code Requirements for Structural Concrete (ACI 318) and latest supplements thereto.

B. Standard Practice for Selecting Proportions for Normal, Heavy Weight, and Mass Concrete (ACI 211.1).

C. "Hot Weather Concreting" (ACI-305R).

D. "Cold Weather Concreting" (ACI-306R).

E. Guide for Measuring, Mixing, Transporting, and Placing Concrete (ACI 304R).

F. Standard Practice for Curing Concrete (ACI 308).

G. Specification for Structural Concrete (ACI 301).

H. Guide for Concrete Floor and Slab Construction (ACI 302.1R).

I. Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete (ASTM C618).

J. Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type) - (ASTM D994).

K. Guide to Formwork for Concrete (ACI 347R).

L. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice.

M. Design and workmanship of all concrete shall be in accordance with referenced specifications and code listed above. Quality, tolerances, and level of performance of work shall be as specified therein. Contractor shall keep on file, in project office, current copies of all references listed above.

PART 2. PRODUCTS

2.01 FORM MATERIALS

A. Form Material for Exposed Concrete: Plywood; 5/8" APA B-B plyform Class 1, exterior. Use plywood thickness sufficient to support concrete at temperature and rate of
pour. Use only sound, undamaged sheets with clean, true edges. Furnish in largest sizes to minimize joints.

B. Form Material for Unexposed Concrete: Plywood; 5/8" APA B-B-G-2, exposure 1, exterior, plywood graded per PS-1 standards for construction and industrial plywood. Use plywood thickness sufficient to support concrete at temperature and rate of pour. Use only sound, undamaged sheets with clean, true edges. Lumber shall be standard grade or better.

C. In lieu of "A" above, the material specified under "B" may be used for exposed concrete if a 3/16" smooth one side, treated, pressed fiberboard liner is utilized.

D. Lumber for light framing (less than 6" wide): standard grade and species. Framing (6" wider and from 2" to 4" thick): provide No. 1 grade in one of the following species:

1. Douglas Fir (WWPA).
2. Southern Pine (SPIB).
3. Redwood (RIS).

E. Prefabricated steel or metal shall be minimum 16 ga. as approved to produce surfaces equal to those specified for wood. Forms shall be matched, tight fitting, and stiffened to support weight of concrete.

F. Metal Form Deck: Utilized to support exterior slabs; shall be S.D.I. approved and equal to Vulcraft. Spacing of slab reinforcing shall be adjusted if required to match corrugations of metal deck.

G. Form Ties: Bolt and rod type so designed that upon removal of the form no metal shall be within 1-1/2" of the concrete surface and no holes larger than 1" in diameter. Concrete exposed to the exterior shall utilize galvanized ties.

H. Dovetail Anchor Slots: Galvanized steel, foam filled, release tape sealed slots, bond tab anchors as manufactured by Heckmann, Hohmann & Barnard, Inc. or approved.

I. Form Release Agent: Colorless mineral oil which will not stain the concrete or impair natural bonding characteristics of coating intended for use on concrete.
J. Formed Construction Joints for Slab-on-Grade: Galvanized steel, tongue and groove type profile with knockout holes to receive doweling, min. 26 gage unless noted otherwise. Size and profile as indicated on drawings or as required to fit field conditions.

K. Slab Edge Joint Filler: ASTM D994, premolded asphaltic board, thickness as indicated or (if not indicated, 1/2" thick minimum).

L. Nails, spikes, lag bolts, through bolts, anchorages: Size as required, of sufficient strength and character to maintain formwork in place while placing concrete.

2.02 REINFORCEMENT MATERIALS

A. Reinforcing Bars: ASTM A 615 Grade 60 deformed.


C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2. For exposed-to-view concrete surfaces where lags of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

D. Inert fiber reinforcement: Polypropylene fiber meeting ASTM-C1116; Fibermesh, Forta Corporation, or other Architect approved U.L. Listed. Add to plant mixed concrete at a rate of 1.5 lbs. per cubic yard of mix.

2.03 CONCRETE MATERIALS

A. Cement; controlling specification for Portland Cement, ASTM C150, Type I-Normal or Type II.

B. Aggregates shall conform to ASTM C-33. Maximum size of aggregate shall not be larger than 1/5 of narrowest dimension between forms of member for which concrete is to be used, nor larger than 3/4 of minimum clear spacing
between reinforcing bars, nor larger than 1/3 of slab depth.

C. Lightweight aggregates shall conform to ASTM C 330.

D. Water: Clean and potable.

E. Air Entrainment Admixture: ASTM C260, as manufactured by Master Builders, Euclid, or W.R. Grace.

F. Chemical Admixtures: ASTM C494; Type 'A' - water reducing; Type 'B' - retarding, Type 'C' - accelerating, Type 'D' - water reducing and retarding, Type 'E' - water reducing and accelerating, Type 'F' - water reducing high range; Type 'G' - water reducing high range and retarding. Calcium chloride or admixtures containing more than .05 percent chloride ions by weight of admixture shall not be used. Each admixture shall not contribute more than 5 ppm by weight, of chloride ions to the total concrete constituent. Use admixtures in strict compliance with manufacturer's directions.

G. Fly Ash: ASTM C618, Type 'C' or 'F'.

H. Bonding Agent: Polymer resin emulsion, W.R. Grace or reviewed/approved equal.

I. Non-Shrink Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents. Capable of developing a minimum compressive strength of 7000 psi at 28 days.

J. Adhesive Anchoring: Injectable adhesive or self-contained capsule as manufactured by:

1. 'Hilti' HIT or HVA System, or Architect approved/reviewed equal.

2.04 CURING COMPOUNDS & SEALERS

A. Curing Compound/Sealer: Liquid curing compound, water base, concrete curing-sealing compound, VOC (volatile organic content) compliant, containing fugitive dye that does not leave residue (resin, varnish, wax, etc.). Fugitive dye must disappear in 7 days, as manufactured by:

1. Sonneborn Building Products, Kure-N-Seal W.
2. Dayton Superior Corporation, Safe Cure & Seal (J-18).
4. MasterKure 100W, Master Builders, Inc.

B. Absorptive Mats: Burlap cloth, commercial quality suitable for purpose. Constructed of jute or kenaf, weighing approximately 9 oz. per square yard, complying with AASHTO M182, Class 2.

C. Moisture retaining cover, complying with ASTM C171; one of the following: waterproof paper, polyethylene film, or polyethylene coated burlap.

2.05 CONCRETE MIX

A. Mix concrete in accordance with ACI 304 and deliver concrete in accordance with ASTM C94.

B. Quality working stresses for the design of this project shall be based on specific minimum 28-day compressive strength of concrete or on specified minimum compressive strength at earlier age at which concrete may be expected to receive full load. Provide concrete of the following properties:

1. Exterior concrete; i.e. supported slabs - 4,000 psi. 28-day compressive strength; water-cement ratio, 0.40 maximum (air entrained).
2. All other concrete - 0.40 maximum (air entrained). 4000 psi. 28-day compressive strength; water-cement ratio, 0.44 maximum (non-air entrained).
3. Footings, walls and piers - 3500 psi. 28-day compressive strength; water-cement ratio, 0.51 maximum (non-air-entrained), 0.46 maximum (air entrained).

C. Slump Limits: Proportion and design mixes to result in concrete slump at the point of placement as follows:

1. Reinforced Foundation Systems: Not less than 1" and not more than 4".
2. All Other Concrete: Not less than 1" & not more than 4".

3. Concrete containing high-range water-reducing admixture (superplasticizer). Not more than 8 inches
after adding admixture to site-verified 2-3 inch slump concrete.

4. Site added water to increase slump is strictly prohibited.

D. Proportions of aggregate to cement shall be such as to produce a mixture which will work readily into corners, angles of forms, and around reinforcement without permitting materials to segregate. Excess free water shall not collect on concrete surface.

E. Fly ash shall not exceed 25% of cement content by weight. No fly ash in slabs.

F. Select admixture proportions for normal weight concrete in accordance with ACI 301, Method 1, and in strict accordance with manufacturer's instructions.

G. Air Entraining Agent: Use in all exterior concrete exposed to weather; i.e. supported slabs, etc. Air entrainment shall be accomplished by use of approved additives used in accordance with manufacturer's instructions. Limit air to 4% minimum to 7% maximum.

H. Adjustment to concrete mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather or other circumstances warrant, as accepted by the Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

PART 3. EXECUTION

3.01 FORMWORK ERECTION

A. Erect formwork, shoring and bracing to achieve design requirements. Fabricate forms for easy removal without hammering or prying against exposed concrete surfaces.

B. Provide bracing to ensure stability of formwork.

C. Apply form release agent to formwork in accordance with manufacturer's instructions, prior to placing for accessories and reinforcement.

D. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent.
E. Clean forms as erection proceeds, to remove foreign matter.

F. Footings and foundations shall be formed, notched and/or sleeved as indicated to provide for installation of mechanical or plumbing piping.

G. Forms shall conform to shape, lines and dimensions of members as called for, substantially and sufficiently tight to prevent leakage of concrete.

H. Forms shall be properly braced, and tied together so as to maintain position and shape. Forms for exposed concrete shall be braced so as to provide dimensions called for, and have taped joints.

I. Construction joints, whether indicated on drawings or not, shall be made or located so as to least impair strength of the structure. Where joint is to be made, the surface of the concrete shall be thoroughly cleaned and all latency removed. In addition, vertical joints shall be keyed.

3.02 INSERTS, EMBEDDED COMPONENTS, AND OPENINGS

A. Provide formed openings where required for work to be embedded in and passing through concrete members.

B. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

C. Install concrete accessories straight, level, and plumb.

3.03 REINFORCEMENT PLACEMENT

A. Place reinforcement, supported and secured against displacement.

B. Ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings.

C. Provide for continuity of reinforcing around corners in footings and walls. Lap corner bars 30 bar diameters.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's instructions.

B. Separate exterior slabs-on-grade from vertical surfaces with ½ inch thick joint filler, extended full thickness of slab. Also, provide filler strips at supported slabs and vertical surfaces.

C. Place concrete continuously between predetermined control and construction joints. Do not break or interrupt successive pours such that cold joints occur. Where applicable, construction joints shall occur at control joint locations, unless noted otherwise.

D. Concrete slabs on grade shall be constructed of thickness indicated. If thickness is not indicated, provide a minimum thickness of 4". Minimum thickness at pipes embedded in concrete shall not be less than three times o.d. of the pipe. All buried piping shall have been tested before placement of concrete.

E. Concrete shall be conveyed from the mixer to place of final deposit by methods which will prevent separation and loss of material.

F. All equipment used for transporting equipment shall be cleaned of all debris. Ice shall be removed from all places to be occupied by concrete forms, and masonry fillers shall be thoroughly wetted except where air temperatures are below 40°F.

G. Equipment for chuting, pumping, pneumatically conveying concrete, shall be such size, and design as to insure practically continuous flow of concrete at delivery and without separation of materials.

H. Concrete shall be deposited as soon as practicable in its final position to avoid segregation due to re-handling, flowing. Concreting shall be carried on at such rate that concrete is at all times plastic and flow readily into space between bars. No concrete that has partially hardened or has been contaminated by foreign materials shall be deposited on work, nor shall re-tempered concrete be used.
I. Concreting, once started, shall be carried on as a continuous operation until placing of panel or section is completed. Top surface shall be generally level.

J. All concrete shall be thoroughly compacted by suitable means during operation of placing and shall be thoroughly worked around reinforcement, embedded fixtures, and into corners of forms. Vibrator shall not be used to flow concrete.

K. Where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack with non-shrink grout or chemical adhesive. Follow manufacturer's recommendations for installation.

L. Construct all concrete site work items to shape, size, thickness and elevations shown. Walks, slabs shall be 4" thick unreinforced, unless otherwise shown. Curbs shall be reinforced with bars; other items shall be reinforced as detailed. All parts shall be one-course monolithic construction between joints. Form walks with vertical curves at points where change in grade exceeds 2%, elsewhere as shown. Side form all work. Slope or crown top surfaces of walks, 1/4" per foot to low side or as directed by Architect/Engineer.

M. Provide 1/2" bituminous expansion joint filler along all joints where supported slabs or foundations abut other walks, building walls, etc.

N. Supported slab finish shall be wood float finish textured perpendicular to direction of travel with hair broom.

O. Protecting and sealing: Protect concrete supported slabs, foundations etc., from pedestrian traffic for three days after pouring. Concrete shall be cured using two layers of burlap kept wet for minimum of 5 days; or at Contractor's option, he may use sprayed-on compound according to manufacturer's recommendations as approved by Architect. Curing method used shall not discolor original color of concrete, nor shall white liquid curing compound be used.

3.05 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
3.06 CURING

A. Place absorptive matting and dampen as required.

B. Immediately after placement, protect concrete from premature drying.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

D. Provisions shall be made for maintaining concrete in moist condition for at least 5 days after placement, except high early concrete which shall be cured for at least 2 days.

E. Cold Weather Requirements:

1. General: Except as modified herein, all work shall be in accordance with ACI 306.

2. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near freezing weather. No frozen materials or materials containing ice shall be used.

3. All concrete materials, all reinforcement, forms, fillers, ground with which concrete is to come in contact shall be free from frost. Whenever temperature of surrounding air is below 40° F., all concrete placed in forms shall have a temperature of between 70° F., 80° F. Adequate means shall be provided for maintaining temperature of not less than 70° F. for 3 days, 50° F. for 5 days, except high early concrete shall have temperature maintained at not less than 70° F. for 2 days, 50° F. for 3 days, or for as much more time as necessary to insure proper curing. Housing, covering, other protection used in connection with curing shall remain in place at least 24 hours after artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for prevention of freezing.

F. Weather Conditions:
1. In hot weather, sprinkle and cover all concrete for at least 24 hours longer than specified for normal curing periods.

2. In weather when temperature falls below freezing, and in any event between December 1 and April 1, no concrete shall be poured without adequate frost protection.

3.07 CONCRETE FINISHING

A. Provide concrete surfaces to be left exposed, concrete walls, columns, etc., with smooth rubbed finish not later than one day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

3.08 FIELD QUALITY CONTROL

A. Inspection and testing shall be performed by firm retained by the Owner. Firm shall be an independent testing lab as selected in accordance with Division 1, Section 01400 “Quality Control”.

B. The Contractor shall notify the Architect/Engineer and the Testing Lab at least five (5) days prior to the commencement of concrete operations.

C. See Division 1 for inspection and testing requirements, Section 01400 “Quality Control”.

D. Specimens shall be molded and cured as per ASTM C31. Three specimens per test, not less than one test for each day's pour, each 50 yards concrete poured, each building unit, or each strength concrete. Specimens shall be laboratory cured.

E. Specimens shall be tested in accordance with ASTM C39. One specimen shall be tested at 7 days, two at 28 days.

F. When average strength of laboratory control cylinders fall below required compressive strength, Architect shall have right to order change in proportions and water content for remainder of structure. Architect shall have right to require tests as per ACI Building Code; Chapter 20 where load tests show concrete does not conform with
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

drawings or specifications. Deficiency shall be corrected without additional cost to Owner.

G. Four copies of test reports at 7 days, 28 days, shall be sent directly to Architect by Testing Laboratory, with all required information shown.

H. Slump tests per ASTM C-172 and C-143, minimum of one test for each set of cylinders, or more as conditions warrant. Deliveries exceeding specified slump shall be rejected.

3.09 DEFECTIVE CONCRETE

A. Modify or replace concrete not conforming to required lines, details and elevations, as directed by Architect/Engineer.

B. Failure of concrete topping to bond to substrate (as evidenced by a hollow sound when tapped), or disintegration or other failure of topping to perform as a floor finish, will be considered failure of materials and workmanship. Repair or replace toppings in areas of such failures, as directed.

END OF SECTION
PART 1. GENERAL

1.01 SUMMARY

A. This specification describes the use of a bonding bridge between new portland-cement mortar or concrete and hardened portland-cement mortar or concrete.

1.02 QUALITY ASSURANCE

A. Manufacturing qualifications: The manufacturer of the specified product shall have in existence a recognized quality assurance program and be ISO 9001 Certified, a program of training, certifying and technically supporting a nationally-organized Approved Contractor Program with a re-certification program of its participants for a minimum of 5 years.

B. Contractor qualifications: Contractor shall be an Approved Contractor of the manufacturer of the specified product, who has completed a program of instruction in the use of the specified coating material, and provides a certification from the manufacturer attesting to its Approved Contractor status.

C. Install materials in accordance with all safety and weather conditions required by manufacturer, or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.03 DELIVERY, STORAGE AND HANDLING

A. All materials must be delivered in original, unopened containers with the manufacturer’s name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.

B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.

C. Condition the specified product as recommended by the manufacturer.

1.04 JOB CONDITIONS
A. Environmental Conditions: Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature 40°F (5°C) and rising.

B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified coating.

1.05 SUBMITTALS

A. Submit two copies of manufacturer’s literature, to include: Product Data Sheet, System Data Sheet, Application Guide, and appropriate Material Safety Data Sheets (MSDS).

B. Submit copy of Certificate of Approved Contractor status by manufacturer.

1.06 WARRANTY

A. Provide a written warranty from the manufacturer against defects of materials for a period of five (5) years, beginning with date of substantial completion of the project.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Sika Armatec 110 EpoCem, as manufactured by Sika Corporation, 201 Polito Avenue, Lyndhurst, NJ 07071 is considered to conform to the requirements of this specification.

2.02 MATERIALS

A. Epoxy resin/portland cement adhesive shall be Sika Armatec 110 EpoCem.

1. Component “A” shall be an epoxy resin/water emulsion containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.

2. Component “B” shall be primarily a water solution of a polyamine.

3. Component “C” shall be a blend of selected portland cements and sands.

4. The material shall not contain asbestos.

2.03 PERFORMANCE CRITERIA
A. Properties of the mixed epoxy resin/portland cement adhesive.
1. Pot Life: 90 minutes @ 73°F.
2. Contact Time: 95°F (35°C) 6 hours
   68°F (20°C) 12 hours
   50°F (10°C) 16 hours
   40°F (5°C) 24 hours
3. Color: Dark gray

B. Properties of the cured epoxy resin/portland cement adhesive.
1. Compressive Strength (ASTM C-109)
   a. 3 day: 4500 psi (31.0 MPa)
   b. 7 day: 6500 psi (44.8 MPa)
   c. 28 day: 8500 psi (58.6 MPa)
2. Splitting Tensile Strength (ASTM C-496)
   a. 28 days: 600 psi (4.1 MPa)
3. Flexural Strength (ASTM C-348)
   a. 1250 psi (8.6 MPa)
4. Bond Strength ASTM C-882 at 14 days
   a. Wet on Wet, 0-hr. open time: 2800 psi (19.3 MPa)
   b. 24-hr. open time: 2600 psi (17.9 MPa)
5. Bond of Steel Reinforcement to Concrete (Pullout Test)
   a. Sika Armatec 110 coated: 625 psi (4.3 MPa)
   b. Epoxy coated: 508 psi (3.5 MPa)
   c. Plain Reinforcement: 573 psi (3.95 MPa)
6. The epoxy resin/portland cement adhesive shall not produce a vapor barrier.
7. Material must be proven to prevent corrosion of reinforcing steel when tested under the procedures as set forth by the Federal Highway Administration Program Report No. FHWA/RD86/193. Proof shall be in the form of an independent testing laboratory corrosion report showing prevention of corrosion of the reinforcing steel.

Note: Tests above were performed with material and curing conditions at 73°F and 45-55% relative humidity.
A. Mixing the epoxy resin: Shake contents of Components “A” and Component “B”. Completely empty both components into a clean, dry mixing pail. Mix thoroughly for 30 seconds using a jiffy paddle with a low-speed (400-600 rpm) drill. Slowly add the entire contents of Component “C” while continuing to mix for 3 minutes until uniform with no lumps. Mix only that quantity that can be applied within its pot life.

B. Placement procedure for Bonding bridge:

1. Apply to prepared surface with a stiff-bristle brush, broom or “hopper-type” spray equipment.
   a. For hand-applied mortars-Place fresh, plastic concrete/mortar while the bonding bridge adhesive is “wet” or within open times indicated in section 2.03.A.2.
   b. For machine-applied mortars-Apply while the bonding bridge adhesive is “wet” or within the open times indicated in section 2.03.A.2.

C. Placement procedures for anti-corrosion coating:

1. Apply to prepared steel surface with a stiff-bristle brush, or “hopper type” spray equipment at 20 mils minimum thickness. Properly coat the underside of the totally exposed steel. Allow to dry (approx 2-3 hours) then apply a second coat at 20 mils minimum thickness. Allow drying again before placing repair mortar.

*During the anti-corrosion coating method, after applying the second coat Sika Armatec 110 EpoCem, a mortar can be applied to “wet” Sika Armatec 110 EpoCem or within open times indicated in section 2.03.A.2 to achieve the benefit of bonding bridge.

D. Adhere to all limitations and cautions for the epoxy resin/Portland cement adhesive in the manufacturer’s current printed literature.

3.02 CLEANING

A. The uncured epoxy resin/Portland cement adhesive can be cleaned from tools with water. The cured epoxy resin/Portland cement adhesive can only be removed mechanically.

B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.
SECTION 03350 – TERRAZZO POLISHING

PART 1 GENERAL

1.01 SUMMARY
A. Section Includes: This Section specifies Dyed and polished concrete.

1.02 REFERENCES
A. American Concrete Institute (ACI):
   1. ACI 302.1R Guide for Concrete Floor and Slab Construction.
B. ASTM International:
C. Reunion Internationale des Laboratoires D'Essais et de Recherches sur les Materiaux et les Constructions (RILEM):
   1. Rilem Test Method 11.4 Standard Measurement of Reduction of Moisture Penetration Through Horizontal Concrete Surfaces.
D. National Floor Safety Institute (NFSI):

1.03 SYSTEM DESCRIPTION
A. Performance Requirements: Provide polished flooring that has been selected, manufactured and installed to achieve the following:
   1. Abrasion Resistance: ASTM C779, Method A, high resistance, no more than 0.008 inch (0.20 mm) wear in 30 minutes.
   2. Reflectivity: Increase of 35% as determined by standard gloss meter.
   3. Waterproof Properties: Rilem Test Method 11.4, 70% or greater reduction in absorption.
B. Design Requirements:
1. Hardened Concrete Properties:
   a. Minimum Concrete Compressive Strength: 4000 psi. (using standard mix of sand & gravel small stone aggregate to achieve a salt & pepper finish look).
   b. Normal Weight Concrete: No lightweight aggregate.
   c. Non-air entrained.

2. Placement Properties:
   a. Natural concrete slump of 4 1/2 inches - 5 inches (114 - 127 mm). Admixtures may be used.
   b. Flatness Requirements:
      1) Overall FF 40.
      2) Local FF 20.

3. Hard-Steel Troweled (3 passes) Concrete (with laser screeding): Steel power troweled (knock off troweling blades) No burn marks. Finish to ACI 302.1R, Class 5 floor.

4. Curing Options: (cure per manufacturer’s recommendations and specifications).
   a. Membrane forming curing compounds (ASTM C309, Type 1, Class B, all resin, dissipating cure).
      1) Acrylic curing and sealing compounds not recommended.
   b. Sheet membrane (ASTM C171); polyethylene film not recommended.
   c. Damp Curing: Seven day cure with “Ultra Cure” blankets.
   d. Do not use fossil fuel heaters during curing (will cause carbonated concrete).

1.04 ACTION SUBMITTALS
   A. General: Submit listed action submittals in accordance with Contract Conditions and Section 01330 - Submittal Procedures.
   B. Shop Drawings: Indicate information on shop drawings as follows:
      1. Typical layout including dimensions and floor grinding schedule.
      2. Plan view of floor and joint pattern layout.
      3. Areas to receive colored surface treatment.
      4. Hardener, sealer, densifier in notes.
C. Product Data: Submit product data, including manufacturer’s SPEC-DATA® product sheet, for specified products.
   1. Material Safety Data Sheets (MSDS).
   2. Preparation and concrete grinding procedures.
   3. Colored Concrete Surface, Dye Selection Guides.

1.05 INFORMATION SUBMITTALS

A. Quality Assurance:
   1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties as cited in 1.03 Performance Requirements.
   2. Certificates:
      a. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
      b. Letter of certification from the National Floor Safety Institute confirming the system has been tested and passed phase Two Level of certification when tested by Method 101-A.
      c. Current contractor’s certificate signed by manufacturer declaring contractor as an approved installer of polishing system.
   3. Manufacturer’s Instructions: Manufacturer’s installation instructions.

1.06 CLOSEOUT SUBMITTALS

A. Warranty: Submit warranty documents specified.

B. Operation and Maintenance Data: Submit operation and maintenance data for installed products in accordance with Section 01700 – Contract Closeout, 01720 – Project Record Documents, 01730 – Operations & Maintenance Data.

1. Include:
   a. Manufacturer’s instructions on maintenance renewal of applied treatments.
   b. Protocols and product specifications for joint filing, crack repair and/or surface repair.
1.07 QUALITY ASSURANCE

A. Qualifications:
   1. Installer must be a L & M FGS Permashine certified installer for at least five years with references of at least ten successfully installed FGS Permashine Concrete Floor Systems similar to that required for this project of 10,000 SF or larger.
   2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

B. Regulatory Requirements.
   1. NFSI Test Method 101-A Phase Two Level High Traction Material.

C. Mock-Ups:
   1. Construct mock-ups in accordance with Section 01400 - Quality Requirements.
   2. Mock-Up Size: Size as indicated on drawings. Provide sample panel at jobsite at location as directed under conditions similar to those which will exist during actual placement.
   3. Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, color selection and shine.
   4. Allow 72 hours for inspection of mock-up before proceeding with work.
   5. When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

D. Preinstallation Meetings: Conduct a preinstallation meeting to verify project requirements, manufacturer’s installation instructions and manufacturer’s warranty requirements. Comply with Section 01310 - Meetings. Review the following:
   1. Environmental requirements.
   2. Scheduling and phasing of work.
   3. Coordinating with other work and personnel.
4. Protection of adjacent surfaces.
5. Surface preparation.
6. Repair of defects and defective work prior to installation.
7. Cleaning.
8. Installation of polished floor finishes.

1.08 DELIVERY, STORAGE & HANDLING

A. Ordering: Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

B. Delivery:
   1. Deliver materials in manufacturer’s original packaging with identification labels and seals intact.

C. Storage and Protection:
   1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   2. Protect concrete slab.
      a. Protect from petroleum stains during construction.
      b. Diaper hydraulic power equipment.
      c. Restrict vehicular parking.
      d. Restrict use of pipe cutting machinery.
      e. Restrict placement of reinforcing steel on slab.
      f. Restrict use of acids or acidic detergents on slab.

D. Waste Management and Disposal:
   1. Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.09 PROJECT AMBIENT CONDITIONS

A. Installation Location: Comply with manufacturer’s written recommendations.
1.010 SEQUENCING
   A. Sequence With Other Work: Comply with manufacturer’s written recommendations for sequencing construction operations.

1.011 WARRANTY
   A. Project Warranty: Refer to Contract Conditions for project warranty provisions.
   B. Manufacturer’s and Installers Warranty: Submit a (10) year no dust warranty and a high traction certification by the National Flooring Safety Institute regarding test method NFSI-101-B, for Owner’s acceptance, executed by the authorized company official for both manufacturer and installer. Manufacturer’s warranty described above is in addition to, and does not limit, other rights Owner may have under Contract Documents.
   C. Warranty: Commencing on date of Substantial Completion as determined by Architect.

1.012 MAINTENANCE
   A. Comply with manufacturer’s written instructions to maintain installed product.

1.013 EXTRA MATERIALS
   A. General Contractor to provide maintenance materials in accordance with Section 01700 - Contract Closeout.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Ensure manufacturer has minimum 5 (five) years experience in manufacturing components similar to or exceeding requirements of project.

2.02 Polished Concrete Finishing Products (L & M Chemical FGS Permashine Floor Polishing 3000 Grit System).
   A. Manufacturer: L & M Construction Chemicals, Inc.
      1. Contact: 14851 Calhoun Rd., Omaha, NE 68152-1140; Telephone:
B. Proprietary Products/Systems:

1. Hardener, Sealer, Densifier: Proprietary, water based, odorless liquid, VOC compliant, environmentally safe chemical hardening solution leaving no surface film.

2. Joint Filler: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control joint and crack filler with Shore A 80 or higher hardness.
   a. Acceptable Material: L & M Construction Chemicals, Inc., Joint Tite 750. (Install before last metal grinding process and if colored concrete is required).

3. Oil Repellent Sealer: Ready to use, silane, siloxane and fluoropolymers blended water based solution sealer, quick drying, low-odor, oil and water repellent, VOC compliant and compatible with chemically hardened floors.

4. Concrete Dyes: Fast-drying dye, packaged in premeasured units ready for mixing with VOC exempt solvent; formulated for application to polished cementitious surfaces.
   a. Acceptable Material: L & M Construction Chemicals, Inc., Vivid Concrete Dyes. (apply with (2) coats after last polish step of the 400 grit polish).

5. Cleaning Solution: Proprietary, mild, highly concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe and certified High Traction by National Floor Safety Institute (NFSI).


7. Color: As selected by Architect from manufacturer’s standard (24) color range.

2.03 SOURCE QUALITY CONTROL
A. Ensure concrete finishing components and materials are from single manufacturer.

2.04 PRODUCT SUBSTITUTIONS

A. Substitutions: No substitutions or alternates permitted.

PART 3 EXECUTION

3.01 MANUFACTURERS INSTRUCTIONS

A. Compliance: Comply with manufacturer’s written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and L & M Construction Chemicals, Inc., SPEC-DATA sheets.

B. Use only L & M certified FGS/PermaShine installers, meeting requirements of 1.07 A Qualifications of this Spec Section.

3.02 EXAMINATION

A. Site Verification of Conditions:
   1. Verify that concrete substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer’s instructions prior to installation of concrete finishing materials.

B. Verify Concrete Slab Performance Requirements:
   1. Verify concrete is cured to 28 day and 4000 psi in strength.
   2. Verify concrete surfaces received a hard steel-trowel finish (3 passes) during placement (laser screeded steel power troweled with knock off troweling blades).

3.03 PREPARATION

A. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of concrete finishing materials.

B. Examine surface to determine soundness of concrete for polishing.

C. General Contractor to remove surface contamination.
3.04 INSTALLATION

A. Floor Surface Polishing and Treatment:

1. Provide polished concrete floor treatment in entirety of slab indicated by drawings. Provide consistent finish in all contiguous areas.

2. Apply floor finish prior to installation of fixtures and accessories.

3. Diamond polish concrete floor surfaces with a Prep Master 1500 pound head pressure diamond grinding machine as recommended by floor finish manufacturer. Sequence with coarse to fine grit using dry method as follows (polishing can start 14 days after pour on properly cured concrete):
   a. Diamond grind the entire concrete slab with 60 grit metal diamonds.
   b. Diamond grind the entire concrete slab with 80 grit metal diamonds.
   c. Diamond grind the entire concrete slab with 100 grit metal diamonds.
   d. Polish the entire concrete slab with 200 grit phenolic 10 segment resin diamond polish pads.
   e. Polish the entire concrete slab with 400 grit phenolic 10 segment resin diamond polish pads. Then apply the Vivid Dye in areas noted.
   f. Polish the entire concrete slab with 800 grit phenolic 10 segment resin diamond polish pads.
   g. Polish the entire concrete slab with 1500 grit phenolic resin diamond polish pads. Once this is complete apply the liquid FGS Permashine Hardener Plus at 250 sf per gallon. Work into the concrete surface until it gels then pick up with a floor scrubber.
   h. Polish the entire surface to a 3000 grit finish.

4. Dyed and Polished Concrete:
   a. Locate demarcation line between dyed surfaces and other finishes.
   b. Polish concrete to final finish level as indicated in 3.04 A.3.
c. Apply diluted dyes to polished concrete surface.

d. Allow dye to dry.

e. Remove residue with dry buffer (floor scrubber); reapply as necessary for desired result.

5. Apply FGS Hardener Plus, Hardener, Densifier As Follows:
   a. First coat at 250 ft²/gal (6.25 m²/L).
   b. Second coat at 350 ft²/gal (8.75 m²/L).
   c. Follow manufacturer’s recommendations for drying time between successive coats.
   d. Remove excess coating after it gels with a dry buffer (floor scrubber).

6. Remove defects and repolish defective areas.

7. Finish edges of floor finish adjoining other materials in a clean and sharp manner.

3.05 ADJUSTMENTS

A. Polish to higher gloss those areas not meeting specified gloss levels per mock-up.

B. Fill joints flush to surface.

3.06 FINAL CLEANING

A. Do cleanup in accordance with Section 01550 – Clean Up and Final Cleaning.

B. Mechanically scrub treated floors for seven days with soft to medium pads with approved cleaning solution.

C. Upon completion, General Contractor must remove surplus and excess materials, rubbish, tools and equipment.

3.07 PROTECTION

A. Protect installed product from damage during construction.

B. Protect with EZ Cover™ by McTech Corp., or comparable product.
   1. Contact: Phone: (866) 913-8363; website: www.ezform.net.
3.08 SCHEDULE

A. High Gloss Finish as described above, color and pattern as indicated on drawings.
SECTION 04100 - MORTAR & GROUT

PART 1. GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification. Refer to Structural Drawings for additional information.

1.02 SECTION INCLUDES

A. Work included in this section consists of furnishing all labor, materials, equipment, and incidentals required for complete installation of mortar and grout for masonry.

B. Related work specified elsewhere:

1. Section 05120 Structural Steel (Non-shrink grout).

1.03 ENVIRONMENTAL REQUIREMENTS


PART 2. PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C150, Type I provide natural color or white cement as required to provide mortar color indicated.

B. Mortar Aggregate: ASTM C144, standard masonry type.

C. Hydrated Lime: ASTM C207, Type 'S', or 'N'.

D. Masonry Cement: ASTM C91.

E. Premix Mortar: ASTM C387.

F. Grout Aggregate: ASTM C404.

G. Grout Fine Aggregate: ASTM C144, 100% passing #8 sieve, maximum 5-30% passing #50 sieve.

H. Water: Clean and potable.
I. Integral water repellant additive meeting ASTM E-514.

J. Plasticizer:
   1. SIKA Chemical Corporation "Inraplast Z".
   2. Euclid Chemical Co. "Eucon BK-S".

K. Storage of all material shall prevent the intrusion of foreign matter. Store all masonry units on the ground, protected against damage and intrusion of excess moisture. No damaged or deteriorated materials shall be used.

2.02 MORTAR MIXES

A. Mortar for exterior load bearing walls and all exterior masonry work below grade; ASTM C270, Type 'M' or 'S', using the property method unless noted otherwise on structural drawings. Use ASTM C270 Type 'N' above grade at exterior veneers.

B. Mortar for interior non-load bearing walls and partitions: ASTM C270, Type 'M' or 'S', using the property method.

C. Mortar for reinforced masonry ASTM C270, Type 'S', using the property method.

D. Pointing mortar for masonry veneers ASTM C270, Type 'N', using the property method.

E. Mortar Pigments: Natural and synthetic milled, blended iron oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.

   1. Provide colored mortar pigments: Color shall be as selected by Architect from SGS concentrated A, H and X Series mortar colors as manufactured by Solomon Colors, Springfield, IL 800-624-0261.
      a. Carbon added for darker colors shall not exceed 4%.
      b. Mix shall product uniform and consistent color.
      c. Inert, stable to atmospheric conditions, sun fast, weather resistant, alkali resistant, water insoluble, lime proof and non bleeding.
      d. Free of deleterious fillers and extenders.
      e. Practice size: 95 to 99% minus 325 mesh.
      f. pH: 6.5 to 9.0.
      g. Shall be tested per ASTM C91 and ASTM C270.
Exceed 1800 psi at 28 days strength requirement.

F. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this Article; combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

2.03 MORTAR MIXING

A. Thoroughly mix mortar ingredients in approved type mixing machine in quantities needed for immediate use in accordance with ASTM C270 or C780. Discharge mixer completely before recharging.

B. All exterior above grade mortar exposed to moisture shall be fabricated with integral water repellant additive.

C. Blend admixtures in accordance with manufacturer's instructions.

D. Do not use anti-freeze compounds to lower the freezing point of mortar.

2.04 GROUT MIXES

A. Bond beams, lintels, engineered masonry, reinforced masonry walls: min. 3000 psi strength at 28 days unless noted otherwise; 8-10 inches slump; pre-mixed grout in accordance with ASTM C94, or batch mixed in accordance with ASTM C476 for fine or course grout.

PART 3. EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Apply bonding agent to existing concrete surfaces.

3.02 INSTALLATION

A. Install pre-mix mortar and grout in accordance with
B. Work grout into masonry cores and cavities to eliminate voids. Do not displace reinforcement. Reinforcing shall be mechanically anchored in masonry cores to prevent displacement during grouting.

END OF SECTION 04100
SECTION 04270 - GLASS UNIT MASONRY

PART 1  GENERAL

1.1 SECTION INCLUDES

A. Glass blocks, hollow.
B. Accessories.
C. Mortar.

1.2 RELATED SECTIONS

A. Section 04100 – Mortar and Grout
B. Section 04300 – Unit Masonry
C. Section 07920 – Sealants and Caulking

1.3 REFERENCES


1.4 SUBMITTALS

A. Submit under provisions of Section 01330 “Submittals”.
B. Product Data: Submit manufacturer's literature, installation and preparation instructions and recommendations, and storage and handling requirements and recommendations.
C. Verification Samples:
   1. Two glass block units of each type specified, showing size, design, and pattern of faces.
2. Representative samples of panel reinforcing, panel anchors, expansion strips, and sealant, as required for project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging in clean, cool, dry area until ready for installation.
B. Protect opened cartons of glass block against windblown rain or water run-off with tarpaulins or plastic covering.

1.6 PROJECT CONDITIONS

A. Do not install glass block units when temperature is 40 degrees Fahrenheit (4 degrees Celsius) and falling.

1.7 WARRANTY

A. Glass Block Units: Limited 5 year warranty on product only.

PART 2  PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Pittsburgh Corning Corporation; 800 Presque Isle Drive, Pittsburgh, PA 15239. ASD. Tel: (800) 624-2120. Tel: (724) 327-6100. Fax: (724) 325-9704. Website: www.pittsburghcorning.com.

B. Requests for substitutions will be considered in accordance with provisions of Section 01630 “Product Substitutions”.

C. Warrant that substitutions will provide performance equivalent to materials specified herein by providing supporting technical data, samples and published specifications.

2.2 GLASS BLOCKS
A. Glass Blocks: General.
   1. Finish: Polyvinyl butyral edge coating.
   2. Framing: Framed and anchored using panel anchor construction.

B. Glass Blocks: Thickset 60 (60 min fire rated)
   1. Pattern: Vue (clear).
   2. Size: Face, 8” by 8”, nominal thickness, 4”.
   3. Weight Installed with Mortar: 25 lb/sq ft.
   4. Thermal Conductance (U Value): 0.51 Btu/hr sq ft deg F winter night.
   5. Thermal Resistance (R Value): 1.96 deg F hr sq ft/Btu.
   7. STC Rating: 48
   8. Impact Strength: 50 to 60 pounds minimum.

2.3 ACCESSORIES

A. Panel Reinforcing: Two parallel 9 gage wires either 1-5/8 inches (41 mm) or 2 inches (51 mm) on center with electrically butt-welded crosswires spaced at regular intervals, galvanized after welding; complying with ASTM A 82 and ASTM A 153.

B. Panel Anchors: 20 gage perforated steel strips 24 inches (610 mm) long by 1-3/4 inches (44 mm) wide, hot dipped galvanized after perforation.

C. Expansion Strips: Polyethylene foam with thickness of 3/8 inch (10 mm).

D. Asphalt Emulsion: Water-based; complying with ASTM D 1187 or D 1227 as applicable to substrate.

E. Sealant (caulk): Non-staining; waterproof mastic; urethane type. Provide fire retardant type sealant for head and jamb locations at fire rated locations.

F. Mortar: Type S, in accordance with ASTM C 270; 1 part Portland Cement, 1/2 part lime, and sand to equal 2-1/4 to 3 times the amount of cementitious material, all
measures by volume; add integral type waterproofer for exterior glass block panels; antifreeze compound or accelerators are unacceptable.

1. Portland Cement: Type 1, in accordance with ASTM C 150.
   a. Color: As selected by architect from the manufacturer's full line of colors.

2. Lime: Type S, in accordance with ASTM C 207; use pressure hydrated dolomitic lime, providing that not less than 92 percent of active ingredients are completely hydrated.

3. Sand: Clean, white quartzite essentially free of iron compounds, in accordance with ASTM C 144; not less than 100 percent passing a No. 8 sieve.

4. Integral Type Water-Repellant: Stearate; as recommended by block manufacturer.

5. External Type Waterproofer: Water based silane sealer; as recommended by block manufacturer.

PART 3  EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that structural members supporting glass blocks are designed for maximum deflection of L/600 under installed load.

D. Verify that panel anchors or channels for support at head and jambs are properly installed.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions with glass blocks set in full mortar bed with joint reinforcing at 16 inches (406 mm) on center and in joints immediately above and below openings.

B. Paint sills of all panels with heavy coat of asphalt emulsion and dry for minimum two hours before first mortar bed is placed.

C. Make provision for expansion and movement at jambs and heads of all panels; do not allow structural loads to bear on glad blocks.

D. Mix mortar and apply in accordance with manufacturer's recommendations.

E. Non masonry fire rated steel stud and gypsum board wall assemblies receiving fire rated glass block must conform to UL listed wall assembly #U465.

3.4 CLEANING

A. Remove excess sealer from glass surfaces immediately following application.

B. Remove excess mortar from faces of glass block at time joints are struck or tooled.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Maintain temperature of glass unit masonry above 40 degrees Fahrenheit (4 degrees Celsius) for first 48 hours after construction.
C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 04270
PART 1. GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification.

1.02 SECTION INCLUDES

A. Work included in this section consists of furnishing all labor, materials, equipment and incidentals required for complete installation of concrete masonry and brick units including installation of reinforcement, anchorage and accessories.

B. Related work specified elsewhere:

1. Section 04100 - Mortar & grout

1.03 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following installed compressive strengths (f'm) at 28 days.

1. For concrete Unit Masonry: As follows, based on net area:
   a. For 8” CMU: f’m = 1500 psi
   b. For 12 inch CMU: f’m = 2000 psi

1.04 SUBMITTALS

A. Provide data on concrete masonry units including proposed reinforcing.

B. Shop Drawing for stone trim including cutting and setting diagrams.

C. Reinforcing steel shop drawings (refer to structural drawings for additional information)

D. If specifically requested by the Architect/Engineer, provide samples for verification as follows:

1. Full-size units for each different exposed masonry unit required showing the full range of exposed colors, textures, and dimensions to be expected in
1.05 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

B. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.

C. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Hot and Cold weather requirements: Recommended Practices for Hot or Cold Weather Masonry Construction as published by the Masonry Industry Council.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not install until they are in an air-dried condition.

B. Store 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 masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

PART 2. PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete block (CMU): ASTM C90, medium weight (105-125 pcf). Use for interior wall applications.

2.02 THIN BRICK PANEL SYSTEM

A. Interior Application to be used for the walls in Cafeteria as detailed on drawings.

B. Provide complete system equal to "TABS Wall Systems Panel System", 616-554-5400, www.tabswallsystems.com

C. Brick to be:
   TCP
   Ruffner
   Light
   Thin Brick
   Modular
   Contact: Kim Mehl 248-548-0777

D. Mortar to be standard grey color.

E. Installer to have minimum 5 years experience related to thin masonry support panel systems and shall be an authorized installer of the panel system approved by the manufacturer.

F. Installation shall be in strict accordance with thin brick panel system manufacturers recommendations and instructions.

2.03 REINFORCEMENT AND ANCHORAGE

A. All single wythe joint reinforcement shall be ladder type wire reinforcing consisting of No. 9 gauge deformed side rods, with No. 9 gauge standard ladder type cross rods. All rods shall be mill galvanized using ASTM A153, Class B-2 standards. Out to out spacing of side rods shall be approximately 2" less than the nominal wall thickness. Provide pre-fabricated corners and tee units as required.
B. All multiple wythe/cavity wall joint reinforcement shall be adjustable ladder type mill galvanized in accordance with ASTM A153, Class B-2 standards. Separate adjustable ties extend to engage outer wythe by at least 2” and spaced not more than 16” o.c.

1. Use where horizontal joints of facing wythe do not align with those of back-up and where indicated.
2. Use where facing wythe is of different material than back-up wythe.

C. For anchorage to steel framing, provide manufacturer's standard anchors with crimped 1/4 inch (6.4 mm) diameter wire anchor section for welding to steel and triangular-shaped wire tie section sized to extend within 1 inch (25 mm) of masonry face and wire diameter of 0.25". Provide one tie on each side of framing where masonry abuts. Ties to be spaced at 16" o.c. vertical.

D. Adjustable Steel Wire Wall Ties (For Veneer w/CMU Backup): Formed wire 3/16" diameter high tensile, cold drawn steel wire conforming to ASTM A82, galvanized zinc coated finish, installed at 16" o.c. vertical opposite ladder reinforcing. Provide one tie per 2.66 square feet of wall area minimum.

E. Manufacturers:

1. AA Wire Products Co.
2. Dur-O-Wal.
4. Hohmann and Barnard, Inc.
5. Wire Bond.
6. Other Architect Approved.

F. Reinforcing Steel: ASTM A615, 60-ksi-yield grade deformed steel bars unprotected finish.

2.04 ACCESSORIES

A. Building Paper: 15# asphalt saturated felt.

B. Column Wrap: Waxed corrugated cardboard of 15# asphalt saturated felt.

2.05 LINTELS

A. Lintels shall be steel, precast or cast-in-place in accordance with details as shown or scheduled on the drawings.
PART 3. EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Verify that field conditions are acceptable and ready to receive work. Examine rough-in and built-in construction to verify locations prior to installation.

B. Coordinate placement of anchors supplied to other sections.

C. Employ skilled mechanics, experienced supervision. Lay masonry plumb, true to line, with level, accurately spaced courses. Break vertical joints unless otherwise indicated. Keep bond plumb. Rack courses, where necessary, without tooting. Lay out facing before setting, minimize cutting closures, jumping bond.

D. Do not wet concrete masonry. Lay masonry with complete bearing in full beds of mortar. Butter sides for full vertical joints. Shove units into place. Anchor walls not otherwise bonded with ties every 8", every four (4) courses.

E. Mix units for exposed concrete unit masonry from several pallets as they are placed to provide a uniform blend of colors and textures.

3.02 COURSING

A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness. Lay out walls in advance for accurate spacing of openings, movement type joints, returns, etc. Avoid units of less than half size at corners and jambs.

B. Block unit shall be laid in stack or running bond, as indicated on drawings with vertical joints aligned plumb, horizontal joints level. Joints in back-up work shall be worked out to provide bonding with facing masonry. Joints shall be uniform in width, thickness not to exceed 1/3". Exposed joints in finish work shall be tooled slightly concave, others shall be cut flush.

C. Brick Units: Lay in running, stacked, rowlock and soldier bonds where noted on drawings. Course as detailed on drawings. Form concave mortar joints as detailed.
D. Initial block course (first course above foundation) in walls (interior or exterior) shall be laid in full mortar beds on shells and cross webs; in other locations, units shall be laid in full mortar beds on shells only. Solid block units shall be laid same as brick. Vertical joints between units shall be filled with mortar between shell ends.

E. All non-bearing walls and partitions shall terminate against beam soffits, roof, or structural ceilings, unless otherwise shown on drawings, or as stated below. Build wall to within 3/8" of overhead structure on roof, fill top joint and all voids with non-combustible insulation board which has width of 1" less than wall, then caulk joints.

F. Both bearing and non-bearing masonry walls which enclose corridors, storage or mechanical rooms, shops and other rooms requiring a rated separation from adjacent areas, must have the top joint as well as all voids at roof deck and elsewhere in or over these walls, filled with cement grout, mortar, or plaster bed of at least 2" in width. Where no ceilings occur in the room, said fill shall be troweled flush with the wall surface or surfaces on the exposed side of the wall.

G. All interior and exterior block walls shall have control joints 20'-0" o.c. maximum for exterior and 25'-0" to 30'-0" at interior walls. Line up control joints with joints in foundation wall and joints in face brick. Leave exposed faces on joints ready for caulking. Provide vertical reinforcing in grouted core on each side of exterior masonry control joints. Reinforcing to match vertical wall steel.

H. Bond each course at corners and break vertical joints at least 2". Tee shaped or cross shaped intersecting walls shall have vertical continuous joint. These joints shall be caulked. Provide for continuity of joint reinforcing by providing pre-fabricated "T" shaped or "L" shaped units.

I. Provide welded steel masonry reinforcing placed in every second horizontal course in all block walls with at least one layer below a window sill level and one layer above a lintel level. Lay reinforcing on wall and cover with mortar, bed unit as usual. Longitudinal wire shall be lapped not less than 32 diameters at splices. At corners, cut inside rod and bend to proper angle.
J. Construct bond beams as indicated with concrete grout. Maintain accurate location of reinforcing steel during grout placement.

K. Grout course solid (or use solid units) immediately below veneer, where masonry serves as support for the veneer (i.e. brick ledges).

L. Grout course solid (or use solid units) immediately below window and door openings or other locations where masonry serves as a support for a sill.

M. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry and remove loose masonry units and mortar prior to laying fresh masonry.

3.03 PLACING AND BONDING

A. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

B. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with fire rated compressible joint filler.

3.04 REINFORCEMENT & ANCHORAGES - SINGLE WYTHE MASONRY

A. Walls laid up with concrete block, including where used as back-up shall be reinforced with horizontal steel wall reinforcing as specified. Reinforcing shall be of proper width for block wythe, to have side wires over block shells. Place joint reinforcement at 16" o.c. vertical and continuous in first and second joint below top of walls.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum of 3'-0" beyond each side of opening.

C. Reinforcing in foundation walls (below floor slab) shall be placed every other course, continuous.

D. Terminate reinforcing each side of control joints; lap end joints 12", form corners by cutting and lapping inside wire, bending outside wire; form intersections by cutting and lapping reinforcing from one wall with other wall. Bed side wires completely in mortar.
3.05 REINFORCEMENT & ANCHORAGE - CAVITY WALL MASONRY

A. Install horizontal joint reinforcement 16 inches o.c. vertically. Place joint reinforcement continuous in first joint below top of walls.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

3.06 LINTELS

A. Install loose steel lintels over window openings, door openings and other miscellaneous openings as indicated on the structural plans.

B. Construct concrete block lintels over window openings, door openings and other openings as indicated on the structural plans or otherwise required.

C. Maintain minimum bearing each side of opening of 8" or as specified on structural drawings. Align end of lintel with vertical block joints.

3.07 GROUTED COMPONENTS

A. Reinforce bond beams and pilasters as detailed.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

D. At beam bearing locations, fill masonry cores with grout for a minimum 12 inches either side of member and three courses vertical, unless otherwise noted.

3.08 GROUTED COMPONENTS

A. Reinforce bond beams as detailed.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.
D. At beam bearing locations, fill masonry cores with grout for a minimum 12 inches either side of member and three courses vertical, unless otherwise noted.

3.09 CONTROL AND EXPANSION JOINTS

A. Do not extend horizontal joint reinforcement through control and expansion joints.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the masonry unit. Fill the resultant elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Form expansion joints as detailed.

3.10 BUILT-IN WORK

A. As work progresses, build in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built in the Work furnished by other Sections.

B. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

3.11 POINTING AND CLEANING

A. Point up all exposed existing brick where required, fill all holes and joints; remove loose mortar, cut out defective joints, and repoint where necessary.

3.12 TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Variation from Level Coursing: 1/8 inch in 3 ft. and 1/4 inch in 10 ft.; ½ inch in 30 ft.

3.13 CUTTING AND FITTING
A. Cut and fit for chases, pipes, conduit, sleeves, grounds, and other items. Coordinate with other Sections of Work to provide correct size, shape, and location.

B. Form slots, grooves, chases, recesses, other items required for other trades. Build in all required structural steel, miscellaneous metal, sash anchors, precast concrete anchors, and other items. Bed in mortar to line and level. Build in counter flashing furnished by Roofing Contractor. Check all requirements in advance to eliminate cutting.

C. Do necessary cutting of masonry for installation of items not otherwise provided for. Patch walls, maintain structural stability, appearance, weather resistance.

D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.14 REPAIRING, POINTING AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, 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, opening, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.

C. Remove excess mortar and mortar smears.

D. Clean soiled surfaces with cleaning solution.

E. On completion of pointing and re-pointing of all face brick and block work, interior and exterior, clean thoroughly with "Sure Klean 600", "Craft Klean" or similar prepared detergent, acceptable to brick and/or block manufacturer, applied strictly according to the
manufacturer's instructions with stiff fiber brushes. Drench with clean water immediately after cleaning. Do not use job mixed acid on this project. All cleaning shall be done prior to installation of any finished floor, wall mounted light fixtures, aluminum frames or items subject to damage. Protect aluminum and hollow metal frames, other built-in items.

F. For cleaning pre-faced units, use masonry detergent cleaners in accordance with manufacturer’s directions. Do not use hydrochloric acids or other unbuffered acids. Do not use steel wool or other abrasives.

3.15 MASONRY WASTE DISPOSAL

A. Recycling: Undamaged, excess masonry materials are Contractor’s property and shall be removed from the Project site for his use.

END OF SECTION 04300
PART 1. GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification.

1.02 SECTION INCLUDES

A. Work included in this Section consists of furnishing all labor, materials, equipment and incidentals required for complete installation of all load and non-load bearing exterior structural steel studs and joist framing, fasteners and accessories. Refer to Section 09250 for lightweight metal framing and furring.

B. Related work specified elsewhere:
   1. Section 06100 – Rough Carpentry
   2. Section 09250 – Gypsum Drywall

1.03 SYSTEM DESCRIPTION

A. Size components to withstand design live, dead and wind loads per design drawings or as follows:

   1. Vertical Assembly: Exterior, 25 PSF positive or negative; Interior 5 PSF positive or negative.

   2. Horizontal Assembly: 40 PSF live load.

B. Maximum allowable deflection: Per design drawings or 1/360 of span for all materials other than masonry veneer. 1/720 of span for stud back-up to masonry veneer.

C. Design wall system to provide for movement of components without damage. Contribution from sheathing shall not be considered for lateral deflection.
D. Design system to accommodate construction tolerances, deflection of building structural members, including metal deck and clearances of intended openings.

E. Refer to structural drawings for additional information.

1.04 SUBMITTALS

A. Shop Drawings: Indicate component details, framed openings, bearing required, loading, welds, type and location of fasteners and describe framing connections.

B. Provide stud and joist layout. Submit signed and sealed calculations by the responsible professional engineer for loading, deflection, and stresses of framing, for review and approval.

C. Product Data: Describe materials and finish, product criteria, and limitations.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance, and who is a current member in good standing of the Steel Stud Manufacturer’s Association (SSMA).

B. AISI – American Iron and Steel Institute, Cold-Formed Steel Design Manual.

C. ASTM A446 – Steel Sheet, Zinc Coated (Galvanized) by Hot-Dip Process, Physical (Structural) Quality.

D. ASTM A525 – Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process.

E. ASTM A570 – Hot-Rolled Carbon Steel Sheet and Strip Structural Quality.

F. ASTM A611 – Steel, Cold-Rolled Sheet, Carbon, Structural.
G. ASTM C955 – Load Bearing (Transverse and Axial) Steel Studs, Runners (Track) and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases.

H. AWCI (Association of Wall & Ceiling Industries) – Specification Guide for Cold-Formed Structural Members.


J. AWS D1.3 – Structural welding code – Sheet Steel.

K. SSPC (Steel Structures Painting Council) – Steel Structures Painting Manual.

L. MFMA (Metal Framing Manufacturers Association) – Guidelines for the Use of Metal Framing.

PART 2. PRODUCTS

2.01 FRAMING MATERIALS

A. Manufacturers

1. Clark Steel Framing
2. Dietrich Industries, Inc.
3. Marino/Ware
4. Other Architect approved current member in good standing of the SSMA.

B. Studs: ASTM A446, sheet steel ‘C’ channel shape, solid web, minimum 18-gage, size as noted on drawings, galvanized to G-90 coating class, complying with ASTM C955. Yield strength of 33,000 psi minimum. 25-gage studs are acceptable for interior applications unless noted otherwise.

C. Joists: ASTM A446, Grade 33, sheet steel ‘C’ channel shape, solid web, 18-gage or size as noted on drawings, galvanized to G-90 coating class, complying with ASTM C955.
2.02 ACCESSORIES

A. Bracing, Furring, Bridging, Plates, Gussets, Kickers, Stiffeners, Clips: Formed steel, thickness, same as stud or determined for conditions encountered; same finish as framing members.

B. Screws: ASTM A123, hot dip galvanized to 1.25-oz./sq. ft., self-drilling, self-tapping, No.10 (minimum).

C. Anchorage Devices: Power driven, power actuated or drilled expansion joint as required relative to sub-strata.

D. Welding: In accordance with AWS D1.1 or D1.3.

E. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 with dry film containing minimum of 94 percent zinc dust by weight.

2.03 FABRICATION

A. Fabricate assemblies of sizes and profiles required; with framing members fitted, reinforced and braced.

B. Fit and assemble in largest practical sections for delivery to site, ready for installation.

C. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or distortion.

PART 3. EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Verify that substrate surfaces and building framing components are ready to receive work.
B. Beginning of installation means acceptance of existing conditions and substrate.

3.02 ERECTION OF STUDDING

A. Install components in accordance with manufacturer’s instructions.

B. Align top and bottom tracks; locate to wall layout. Secure with fasteners at maximum 24-inches o.c.

C. Place studs at 16-inches o.c. unless noted otherwise on drawings; not more than 2-inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method. Wire tying of framing members is not permitted.

D. Construct corners using minimum three studs. Double stud each wall opening, door, and window jamb. Install intermediate studs above and below openings to match wall stud spacing.

E. Erect load bearing studs one-piece full length. Splicing of studs is not permitted.

F. Allow for deflection, directly below horizontal building framing, metal decking, etc., for non-load bearing framing.

G. Attach cross studs and furring channels to studs for attachment of fixtures anchored to walls and for attachment of mechanical and electrical items within walls.

H. Touch-up field welds and damaged prefinished surfaces with primer.

I. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

J. Coordinate installation of all wood blocking for installation of items supplied by other trades.
K. Coordinate installation of all framing to accommodate openings required by architectural, mechanical and electrical trades.

3.03 ERECTION OF JOISTS

A. Install components in accordance with manufacturer’s instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

C. Place joists at 16-inches o.c. unless noted otherwise on drawings; position not more than 2-inches from abutting walls. Connect joists to supports using fastener method. Fasten joists to both flanges of joist track.

D. Set joists parallel with lateral bracing and bridging.

E. Locate joist end bearing directly over load bearing studs or provide load-distributing member to top of stud track.

F. Provide web stiffeners at reaction points.

G. Touch up field welds and damaged prefinished surfaces with primer.

3.04 TOLERANCES

A. Maximum variation from true position: 1/4-inch.

B. Maximum variation of any member from plane: 1/4 inch.

END OF SECTION 05400
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

SECTION 05500 - METAL FABRICATIONS

PART 1. GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification.

1.02 SECTION INCLUDES

A. Work included in this section consists of furnishing all labor, materials, equipment and incidentals required for complete installation of miscellaneous metal work shown on the drawings, as specified herein, and/or as needed for a complete and proper installation whether shown or not.

1.03 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

B. Perform shop and/or field welding required in connection with the work of this Section in strict accordance with pertinent recommendations of the American Welding Society.

C. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the work.


1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.04 SUBMITTALS

A. Comply with pertinent provisions of Division 1.
B. Product Data: Within (15) calendar days after the contractor has received the Owner's Notice to Proceed, submit:

1. Shop drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this section with the work of adjacent trades. Provide templates for anchors and bolts specified for installation under other sections.

1.05 PROJECT CONDITIONS

A. Field Measurements: Check Actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

1. Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2. PRODUCTS

2.01 MATERIALS

A. In fabricating items which will be exposed to view, limit materials to those which are free from surface blemishes, pitting, rolled trade names, and roughness.

B. Comply with following standards as pertinent:

1. Steel plates, shapes and bars: ASTM A36.
2. Steel plates to be bent or cold-formed: ASTM A283, Grade C.
7. Steel pipe: ASTM A53, Grade B, standard weight, black finish unless otherwise noted.
8. For exterior installations and where indicated, provide members with hot-dip galvanizing coat per ASTM A53.
9. Concrete inserts:
   a. Threaded or wedge type galvanized ferrous castings of malleable iron complying with ASTM A27.
   b. Provide required bolts, shims, and washers, hot-dip galvanized in accordance with ASTM A153.

2.02 FASTENERS

A. General:
   1. For exterior use and where built into exterior walls, provide zinc-coated fasteners.
   2. Provide fasteners of type, grade, and class required for the particular use.

B. Comply with following standards as pertinent:
   1. Bolts and nuts: Provide hexagon-head regular type complying with ASTM A307, Grade A.
   4. Washers:

2.03 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by contractor subject to the approval of the Architect.

2.04 SHOP PAINT

A. Primer: Use "10-99 Tnemec Primer" or Architect/Engineered equal product by Rustoleum.

B. For repair of galvanizing, use a high zinc-dust content paint complying with SSPC-paint 20. Dry film containing not less than 94 percent zinc dust by weight.
2.05 FABRICATION

A. Except as otherwise shown on the drawings or the approved shop drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.

B. Fabricate with accurate angles and surfaces which are true to the required lines and levels, grinding exposed welds smooth and flush, forming exposed connections with hairline joints, and using concealed fasteners wherever possible.

C. Prior to shop painting or priming, properly clean metal surfaces as required for the applied finish and for the proposed use of the items.

D. On surfaces inaccessible after assembly or erection, apply two coats of the specified primer. Change color of second coat to distinguish it from the first.

E. Shear and punch metals cleanly and accurately. Remove burrs.

F. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

G. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. 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.

2.06 MISCELLANEOUS METAL FABRICATIONS

A. Rough Hardware:

1. Manufacture or fabricate items of sizes, shapes, and dimensions required. Furnish steel washers.

B. Loose Bearing and Leveling Plates:

1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction made flat, free from warps or twists, and of required thickness and
bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

C. Miscellaneous Framing and Supports:

1. Provide miscellaneous steel framing and supports as required to complete work.
2. Fabricate miscellaneous units to sizes, shapes, and profiles shown or, if not shown, or required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes, plates, and steel bars of welded construction using metered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
3. Hot dip galvanize exterior miscellaneous frames and supports.

D. Steel Pipe Railings:

1. Provide railings, guardrails and handrails capable of withstanding the following loads applied as indicated when tested per ASTM E 935.
   a. Concentrated loads of 200 lbs. Applied at any point in any direction.
   b. Uniform load of 50 lbs. Per linear ft. applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
   d. Infill of Guards:
      Concentrated load of 50 lbs. applied horizontally on an area 1 sq. ft.
      Uniform load of 25 lb./ft. applied horizontally.
      Infill load and other loads need not be assumed to act concurrently.
   e. Provide X-Strong pipe (Schedule 80).
2. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator’s option.
3. At tee and cross intersections provide coped joints.
4. At bends interconnect pipe by means of prefabricated elbow fittings or flush radius bends, as applicable.
5. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-section of pipe throughout entire bend without buckling,
twisting or otherwise deforming exposed surfaces of pipe.
6. Provide wall returns at ends of wall-mounted handrails, except where otherwise indicated.
7. Close exposed ends of pipe by welding 3/16” thick steel plate in place or by use of prefabricated fittings.
8. Provide wall brackets, end closures, flanges, miscellaneous fittings and anchors for interconnections of pipe and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete or masonry work.

PART 3. EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this section will be performed and notify the General Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.02 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.03 INSTALLATION

A. General:

1. Set work accurately into position, plumb, level, true and free from rack.
2. Anchor firmly into position.
3. Where field welding is required, comply with AWS recommended procedures of manual-shielded metal-arc welding for appearance and quality of weld and for methods to be used in correcting welding work.
4. Grind exposed welds smooth and touch up shop prime coats.
5. Do not cut, weld, or abrade surfaces which have been hot-dip galvanized after fabrication and which are intended for bolted or screwed field connections.
B. Immediately after erection, clean the field welds, bolted connections and abraded areas of shop priming. Paint the exposed areas with same material used for shop priming.

END OF SECTION 05500
SECTION 06100 - CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

A. The extent of the carpentry work is shown on the Drawings.

1.03 QUALITY ASSURANCE:


B. Factory mark each piece of lumber and plywood with type, grade, mill, and grading agency: West Coast Lumber Assoc. (WBLC) or Western Wood Products Association (WWPA).

1.04 SUBMITTALS:

A. Wood Treatment Data:
   1. Submit treatment manufacturer's instructions for proper use of each type of treated material.
      a. Pressure Treatment: For each type specified, include certification by treating plant stating chemicals and process used, net amount of preservative retained, and conformance with applicable standards.
      b. For water-borne preservatives, include statement that moisture content of treated materials was reduced to a maximum of 15% prior to shipment to project site.

B. Product Data:
   1. Submit manufacturer's specifications and other data for each carpentry anchorage, fastening, and miscellaneous material. Provide material certificates for all lumber and plywood. Transmit a copy of each instruction to the Installer.
1.05 PRODUCT HANDLING:

A. Delivery and Storage: Keep materials dry during delivery and storage. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood and provide air circulation within stacks.

1.06 JOB CONDITIONS:

A. Coordination: Fit carpentry work to other work, scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow proper attachment of other work.

PART 2 - PRODUCTS
2.01 MATERIALS:

A. Lumber - General:

1. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20-05, for the moisture content specified for each use. Use dressed lumber, surfaced four sides (SFS) seasoned with 19% maximum moisture contact at time of dressing.

B. Framing Lumber (2" through 4" thick):

1. For light framing (less than 6" wide), provide Construction Grade Douglas Fir as graded by the West Coast Lumber Bureau (WCLB) or equivalent species and grade with minimum fiber stress rating (bending) of 1000 psi (Fb), and modules of elasticity of 1,500,000 psi.

2. For structural framing (6" and wider and from 2" to 4" thick) provide dense No. 1 Grade Douglas Fir as graded by the West Coast Lumber Bureau (WCLB) or equivalent species and grade with minimum fiber stress rating (bending) of 1500 psi (Fb), and modules of elasticity of 1,700,000 psi.

C. Boards (less than 2" thick):

1. Produce lumber of 19% maximum moisture content (S-DRY) and of the following species and grade.
   a. Redwood Construction Common (RIS).
   b. Southern Pine No. 2 Boards (SPIB).
   c. Or any species graded construction Boards (WCLB or WWPA).
D. Plywood:

1. Provide only Douglas Fir Plywood in accordance with grading requirements of the APA - The Engineered Wood Association as follows:
   a. Treated non-combustible AC standard with exterior glue.

E. Anchorage and fastening Materials:

1. Select proper type, size, material, and finish for each application. Comply with the following:
   b. Wood Screws: FS FF-S-111.
   c. Bolts and Studs: FS FF-B-575.
   f. Lag Screws or Lag Bolts: FS FF-B-561.
   g. Masonry Anchoring Devices: For expansion shields, nails, and drive screws, comply with FS FF-S-325.
   h. Toggle Bolts: FS FF-B-588.
   i. Bar or Strap Anchors: ASTM A 575 carbon steel bars.

2.02 WOOD TREATMENT:

A. Preservation Treatment: Where lumber or plywood is indicated as "Treated" or is specified herein to be treated, comply with the applicable requirements of the American Wood Preservers Association (AWPA) AWPA P23-08, ASTM D-1625 and Federal Specification TT-W-50.

B. Pressure-treat above-ground items with water-borne preservatives complying with AWPA P5-09, ASTM D-1760, and Federal Specification TT-W-571. After treatment, kiln-dry to a maximum moisture content of 19%. Treat indicated items and the following, except where fire retardant treated.
1. Wood cants, nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.

2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

3. Wood framing members less than 12 inches above grade excepting timber.

C. Fire Retardant Treated:

1. Wood blocking and similar items installed within the building shall be pressure impregnation with retardant chemicals to achieve a flame spread rating of not more than 25 when tested in accordance with UL Test 723, ASTM E 84, or NFPA Test 355.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Installer must examine the substrates and supporting structure and the conditions under which the carpentry work is to be installed and notify the Constructor, in writing, of conditions detriment to the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 INSTALLATION:

A. General:

1. Discard units of material with defects which might impair the quality of the work, and units which are too small to fabricate the work with minimum joints or the optimum joint arrangement.

2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.

3. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required. Provide washers under bolt heads and nuts in contact with wood. Nail plywood in accordance with the recommendations of APA-The Engineered Wood Association.
4. Use common wire nails, except as otherwise shown or specified herein. Use finishing nails for exposed work. Do not wax or lubricate fasteners that depend on friction for holding power. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required. Do not drive threaded friction type fasteners; turn into place. Tighten bolts and lag screws at installation and retighten as required for tight connections prior to closing in or at completion of work.

B. Wood Grounds, Nailers, Blocking and Sleepers:

1. Provide wherever shown and where required for screening or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work. Where possible, anchor to form work before concrete placement.

3. Provide permanent grounds of dressed, pressure preservative treated key-bevelled lumber not less than 1-1/2" wide and of the thickness required to bring face of ground to exact thickness of finished material involved. Remove temporary grounds when no longer required.

C. Wood Furring:

1. Install plumb and level with closure strips at all edges and openings. Shim with wood as required for tolerance of finished work.

D. Wood Framing:

1. Provide framing members of sizes and on spacings shown and frame openings as shown, or if not shown, comply with recommendations of "The Wood Frame Construction Manual" 2001 Ed. of the American Wood Council. Do not splice structural members between supports.
2. Anchor and nail as shown, and comply with the "Recommended Nailing Schedule - Table I of the Manual for Housing Framing: and other recommendations of the N.F.P.A."

E. Installation of Plywood:

1. Comply with recommendations of the Engineered Wood Association (APA) for the installation of plywood.

END OF SECTION 06100
SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Interior standing and running trim.
   2. Laminate clad cabinets (plastic-covered casework).
   3. Cabinet tops (countertops).

B. Related Sections: The following sections contain requirements that relate to this section:
   1. Division 6 Section 06100 "Carpentry" for furring, blocking, and other carpentry work that is not exposed to view.
   2. Division 9 Section 09900 "Painting" for final finishing of installed architectural woodwork.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product and process specified in this section and incorporated into items of architectural woodwork during fabrication, finishing and installation.

C. Fire-retardant treatment data for material impregnated by pressure process to reduce combustibility. Include certification by treating plant that treated materials comply with requirements.

D. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
1. Plastic laminate.

2. Factory-applied opaque finishes.

E. Samples for verification purposes of the following:

1. Lumber with or for transparent finish, 50 square inches, for each species and cut, finished on one side and one edge.

2. Veneer leaves representative of and selected from flitches to be used for transparent finished woodwork.

3. Wood veneer faced panel products; with or for transparent finish, 8-1/2 inches by 11 inches, for each species and cut with one half of exposed surface finished, with separate samples of unfaced panel product used for core.

4. Lumber and panel products with factory-applied opaque finish, 8- 1/2 inches by 11 inches for panels and 50 square inches for lumber, for each finish system and color, with one half of exposed surface finished.

5. Laminate clad panel products, 8-1/2 inches, by 11 inches for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.

6. Corner pieces as follows:
   
   a. Cabinet front frame joints between stiles and rail as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.

   b. Miter joints for standing trim.

7. Exposed cabinet hardware, one unit of each type and finish.

F. Product certificates signed by woodwork manufacturer certifying that products comply with specified requirements.

G. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed
projects with project names, addresses, names of Architects and Owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

B. Single-Source Responsibility: Arrange for production by a single firm of architectural woodwork with sequence matched wood veneers.

C. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing and installation.

D. Installer Qualifications: Arrange for installation of architectural woodwork by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.

E. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage and deterioration.

B. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Obtain and comply with Woodwork
Manufacturer's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of woodwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 HIGH PRESSURE DECORATIVE LAMINATE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high pressure decorative laminates which may be incorporated in the work include but are not limited to the following:

B. Manufacturer: Subject to compliance with requirements, provide high pressure decorative laminates from:

1. Wilsonart International

2.2 MATERIALS

A. General: Provide materials that comply with requirements of the AWI woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards that apply to product characteristics indicated:

1. Hardboard: ANSI/AHA A135.4


4. Particleboard: ANSI A208.1


6. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:
   c. Hardwood Plywood: HPMA FE.

B. Fire-Retardant Particleboard: Where indicated on the documents, provide panels complying with the following requirements that have fire-retardant chemicals bonded to softwood particles at time of panel manufacture to achieve products identical to those tested for flame spread of 20 or less and for smoke developed of 25 or less per ASTM E 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.

   1. For 45-lb-density panels and thicknesses of 3/4 inch and less, comply with ANSI A208.1 for Grade 1-M-1 except that minimums for modulus of elasticity and screw-holding capacity on face and edge shall be 300,000 psi, 250 lb, and 225 lb, respectively.

   2. For 44-lb-density panels and thicknesses of 13/16 inch to 1-1/4 inch, comply with ANSI A208.1 for Grade 1-M-1 except that minimums for modulus of rupture, modulus of elasticity, internal bond, linear expansion, and screw-holding capacity on face and edge shall be 1300 psi, 250,000 psi, 60 psi, 0.50 percent, 250 lb, and 175 lb, respectively.

   3. Product: Subject to compliance with requirements, provide "Duraflake FR" by Duraflake Div.; Willamette Industries, Inc.
2.3 FABRICATION, GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of cabinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness: 1/16 inch.
2. Edges of rails and similar members more than 1 inch in nominal thickness: 1/8 inch.

C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Factory-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.

2.4 FIRE-RETARDANT-TREATED LUMBER

A. Low-Hygroscopic Formulation: Interior Type A per AWPA C20.

B. Fire Performance Characteristics: Provide materials identical to those tested for the following fire performance characteristics per ASTM test methods indicated by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify treated lumber with classification marking of inspecting and testing organization in the form of separable paper label or, where required by authorities having jurisdiction, of imprint on lumber surfaces that will be concealed from view after installation.
1. Surface Burning Characteristics: Not exceeding values indicated below, tested per ASTM E 84 for 30 minutes with no evidence of significant combustion.
   b. Smoke Developed: 50.

C. Mill lumber after treatment, within limits set for wood removal that does not affect listed fire performance characteristics, using a woodworking plant certified by testing and inspecting organization.

D. Kiln-dry woodwork after treatment to levels required for untreated woodwork. Maintain moisture content required by kiln drying before and after treatment.

E. Discard treated lumber that does not comply with requirements of referenced woodworking standard. Do not use twisted, warped, bowed, discolored, or otherwise damaged or defective lumber.

F. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include but are not limited to the following:
   2. Osmose Wood Preserving, Inc.

2.5 LAMINATE CLAD CABINETS (PLASTIC-COVERED CASEWORK)

A. Quality Standard: Comply with AWI Section 400 and its Division 400B "Laminate Clad Cabinets."

B. Grade: Custom.

C. AWI Type of Cabinet Construction: As indicated.

D. Laminate Cladding: High pressure decorative laminate complying with the following requirements: (provide fire-rated laminate where indicated on the documents).

2. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   c. Provide selections made by Architect from laminate manufacturer's full range of standard colors and
finishes in the following categories:

1) Solid colors.
2) Patterns.
3. Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.
   a. Horizontal Surfaces Other Than Tops: GP-50 (0.050-inch nominal thickness).
   b. Postformed Surfaces: PF-42 (0.042-inch nominal thickness).
   c. Vertical Surfaces: GP-50 (0.050-inch nominal thickness).
   d. Vertical Surfaces: GP-50 (0.050-inch nominal thickness).
4. Semiexposed Surfaces: Provide surface materials indicated below:

E. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers except where located directly under tops.

2.6 CABINET HARDWARE AND ACCESSORY MATERIALS

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Finish Hardware."

B. Cabinet Hardware Schedule: Refer to schedule at end of this section for cabinet hardware required for architectural cabinets.

C. Hardware Standard: Comply with ANSI/BHMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BHMA numbers or referenced to this standard.

D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA code number indicated.
   1. Satin Stainless Steel, Stainless Steel Base: BHMA 630.
E. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of ANSI/BHMA A156.9.

F. Uncoated Clear Tempered Float Glass for Doors: ASTM C 1048, Condition A, Type I, Class 1, Quality q3. Kind FT, manufactured by horizontal (roller hearth) process, with exposed edges seamed before tempering, 1/4-inch thick unless otherwise indicated.

1. Install glass to comply with applicable requirements of Division 8 Section "Glass and Glazing" and of FGMA "Glazing Manual." For glass in wood frames, secure glass with removable stops.

G. Clear Tempered Float Glass for Shelves: ASTM C 1048, Condition A, style I, type I, quality q3, class 1, seamed at edges before tempering, 1/4-inch thick unless otherwise indicated.

2.7 ARCHITECTURAL CABINET TOPS (COUNTERTOPS)

A. Quality Standard: Comply with AWI Section 400 and its Division 400C.

B. Type of Top: High pressure decorative laminate complying with the following: (provide fire-rated laminate where indicated on the documents).

1. Grade: Custom.
2. Laminate Cladding for Horizontal Surface: High pressure decorative laminate as follows:
   a. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
      1) Match Architect's sample.

3. Edge Treatment: 3MM

C. Fire Performance Characteristics: Provide paneling composed of panels of wood veneer density and fire-retardant particleboard that are identical in construction to units tested for the following surface burning characteristics per ASTM E 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify panels with appropriate markings of applicable testing and inspecting
organization on surfaces that will be concealed from view after installation.
1. Flame Spread: 75 or less.
2. Smoke Developed: 40 or less.

2.8 FASTENERS AND ANCHORS

A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

3. For metal framing supports, provide screws as recommended by metal framing manufacturer.

B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

C. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.

C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

A. Quality Standard: Install woodwork to comply with AWI
Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.

C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer including those for adhesives where are used to install woodwork.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

F. Standing and Running Trim and Rails: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns and miter at corners.

G. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of cabinets with transparent finish.

H. Tops: Anchor securely to base units and other support systems as indicated.

I. Complete the finishing work specified in this section to
whatever extent not completed at shop or before installation of woodwork.

J. Refer to the Division 9 sections for final finishing of installed architectural woodwork.

3.3 ADJUSTMENT AND CLEANING

A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensures that woodwork is being without damage or deterioration at time of Substantial Completion.

3.5 HARDWARE SCHEDULE

A. Keyboard slide and tray: Knape & Vogt KV SRS with platform (BBP1824).

B. Grommets: Mockett 3” o.d. black: MQEDP3BK with fliptop tab.

END OF SECTION 06402
PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

A. The extent of thermal insulation work is shown on the drawings.

B. The applications of thermal insulation specified in this section include the following:

1. Blanket-type building insulation.

C. Related Work Specified Elsewhere:

1. Section 07200 - Standing Seam Metal Roof Deck/Insulation
2. Section 07500 - Flat Roof Insulation
3. Section 07840 - Firestopping: For safing insulation
4. Section 09200 - Exterior Plaster System: Rigid Insulation Board
5. Section 09250 - Gypsum Board: Acoustical batt insulation
6. Division 15, Mechanical: Insulation for ducts, heating, air conditioning, ventilating, and plumbing work shall be furnished and installed by the respective Mechanical Contractor.
7. Division 16, Electrical: Insulation for electrical work shall be furnished and installed by Electrical Contractor.

1.03 QUALITY ASSURANCE:

A. Thermal Conductivity: The thickness shown are for the thermal conductivity (k-value at 75%) specified for each material. Provide adjusted thicknesses as directed for the equivalent use of material having a different thermal conductivity.

B. Fire Ratings: Comply with the fire-resistance and flammability ratings indicated, and comply with governing regulations as interpreted by authorities including:

1. UL requirements for "Roof Deck Constructions" which
are rated "Fire-Acceptable".

1.04 SUBMITTALS:

A. Product Data:

1. Submit manufacturer's specifications and installation instructions for each type of insulation required. Include data substantiating that materials comply with specified requirements.

B. Shop Drawings:

1. Submit shop drawings for tapered roof area. Show all slopes, thickness, perimeter and roof sump conditions.

1.05 PRODUCT HANDLING:

A. Protection from Deterioration: Do not allow insulation materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation. Protect plastic insulation from exposure to sunlight.

B. Fire Hazard: Do not deliver plastic insulating materials to the project site ahead of installation time. Protect at all times against ignition. Complete installation and concealment of plastic materials as rapidly as possible in each area of work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Mineral/Glass Fiber Blanket/Batt Insulation:

1. Unfaced Mineral Fiber Blanket/Batt Insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C665 for type described below with thermosetting resins to comply with ASTM C665 for Type 1 (blankets without membrane facing); and as follows:

a. Mineral Fiber Type: Fibers manufactured from glass.

b. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.

2. Batt insulation shall be foil faced when exterior wall
or ceiling is not indicated to receive a separate vapor barrier. Locations with vapor barrier shall be unfaced. Provide batt insulation equal to or exceeding the "R" values for the following nominal indicated insulation thicknesses.

a. "R" = 11 for 3-1/2 inches thick insulation
b. "R" = 19 for 6-1/4 inches thick insulation

3. Foil-Faced, Glass Fiber Board Insulation: Thermal insulation combining glass fibers with thermosetting resin binders and faced on one side with foil-scrim-kraft or foil-scrim-polyethylene vapor retarder to comply with ASTM C612, Type 1A or Type 1A or 1B, and with other requirements indicated below:

a. Nominal density of 2.25 lb./cu. ft., thermal resistivity of 4.3 degrees F. by high by sq. ft./BTU by inch at 75 degrees F.

4. Miscellaneous Insulation: Shall be inorganic (nonasbestos) mineral wool insulation without facing, for the purpose of filling and stuffing openings in walls around pipes, structural components, windows, conduits, expansion joints to eliminate noise transfer and to insulate. Use to seal top of interior walls, except fire rated walls, between masonry and roof deck, where indicated. Use at expansion joints as detailed. Insulation shall have a flame spread rating of 15 or less, and a smoke development rating of 0; per ASTM E84.

5. All glass fiber insulation types shall be formaldehyde-free. Insulation shall be Johns Manville and meet minimum environmental specifications 1350 with non-detect pollutants for indoor air quality. Other manufacturers must be approved by Architect for comparison.

2.02 AUXILIARY INSULATING MATERIALS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated, securely in position indicated with self-locking washer in place; and complying with the following requirements:
1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

2. Spindle: Copper-coated low carbon steel, fully annealed, 0.105 inches in diameter, length to suit depth of insulation indicated.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016 inch thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
   a. Where spindles will be exposed to human contact after installation, protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap.

4. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates.

5. Products: Subject to compliance with requirements, provide one of the following:
   a. Adhesively attached, spindle type anchors
      1. TACTOO Insul-Hangers; AGM Industries, Inc. Canton, MA
      2. Spindle Type Gemco Hangers; Gemco, Danville, IL
   b. Insulation - Retaining Washers
      1. RC150; AGM Industries Inc, Canton, MA
      2. R150; Gemco, Danville, IL
   c. Adhesive
      1. TACTOO Adhesive; AGM Industries, Inc. Canton, MA
      2. Tuff Bond Hanger Adhesive; Gemco, Danville, IL

PART 3 - EXECUTION

3.01 INSPECTION:

A. The Installer must examine the substrate and conditions under which the insulation work is to be performed, and notify the Construction Manager in writing of
unsatisfactory conditions. Do not proceed with the insulation work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSULATION:

A. General:

1. Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work.

2. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.

3. Apply a single layer of insulation of the required thickness unless otherwise shown or required to make up the total thickness.

B. Perimeter Insulation:

1. On vertical surfaces, set units in adhesives applied in accordance with manufacturer's instructions. Use type adhesive recommended by manufacturer of insulation.

C. General Building Insulation:

1. Apply insulation units to the substrate by the method indicated, complying with the manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage, to provide permanent placement and support of units.

2. Set vapor barrier faced units with vapor barrier to warm side of construction, except as otherwise shown. Do not obstruct ventilation spaces, except for firestopping.

   a. Tape joints and ruptures in vapor barriers, using adhesive tape of type recommended by insulation.
manufacturer, and seal each continuous area of insulation to surrounding construction so as to ensure vapor-tight installation of the units.

3. Stuff loose mineral fiber insulation into miscellaneous voids and cavity spaces as indicated. Compact to approximately 40% of normal maximum volume (to a density of approximately 2.5 lbs. per cu. ft.).

END OF SECTION 07200
SECTION 07840 - FIRESTOPPING

PART I - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this section.

1.02 DESCRIPTION OF WORK:

A. Provide labor and materials necessary for complete installation of firestopping materials and systems. Section includes firestopping for the following:

1. Penetrations through fire resistance rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

2. Penetrations through fire resistance rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits and other penetrating items.

3. Penetrations through smoke barriers and construction enclosing compartmentalized area involving both empty openings and openings containing penetrating items.

4. Sealant joints in fire resistance rated construction.

1.03 SUBMITTALS:

A. Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL or other nationally recognized independent testing laboratories firestop systems to be used and manufacturer's installation instructions.

1. Submit material safety data sheets (MSDS) provided with product delivered to jobsite.
B. Product certificates signed by manufacturers of firestopping products certifying that their products and installation comply with specified requirements. Certification shall be signed by the Installer.

1.04 QUALITY ASSURANCE:

A. Conform to applicable governing codes, including local governing authorities, but not limited to the following:

2. 2015 Michigan Building Code

B. Meet requirements of ASTM E814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated and other ASTM Standards as applicable for the installation.

1. ASTM E84 "Test Method for Surface Burning Characteristics of Building Materials".

PARTS 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with through-penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products by one of the following:

1. Hilti Construction Chemicals, Tulsa, OK
2. Specified Technologies Inc. (STI) Sommerville, NJ
3. 3M Fire Protection Products, St. Paul, MN
4. The Rectorseal Corp., Houston, TX
5. Tremco, Inc. Beachwood, OH

2.02 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
1. All materials shall comply with ASTM E814 or E119 (UL 1429) and shall be manufactured of non-toxic, non-hazardous, asbestos free materials, and unaffected by water or moisture when cured.

2. Primers: Conform to manufacturer's recommendations for primers required for various substrate and conditions.

3. Backup materials: Backup materials, supports, and anchoring devices shall be provided as required by UL testing.

B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire resistance rated system. Accessories include but are not limited to the following items:

1. Permanent forming/damming/backing materials must be noncombustible and may include the following:
   a. Semirefractory fiber (mineral wool) insulation.
   b. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
   c. Joint fillers for joint sealants.

2. Temporary forming materials.
5. Steel sleeves.

2.03 FIRE STOPPING, MATERIALS

A. Use only firestopping products that have been UL 1479 or ASTM E814 tested for specific fire rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

B. For penetrations by noncombustible items including steel pipe, copper pipe, rigid steel conduit, and electrical metallic tubing (EMT), the following materials are acceptable:
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

1. Hilti FAS 601 Elastomeric Firestop Sealant
2. STI SpecSeal Sealant SSS 100
3. 3M Fire Barrier CP25
5. Fyre-Sil, Tremco, Inc.

C. For penetrations by combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems) the following materials are acceptable:

1. STI Wrap Strip SSW12
2. Hilti FS One Intumescent Firestop Sealant
3. 3M Fire Barrier FS-195 Wrap Strip
5. Biostop Wrap Strip, Collar, and Biostop 500+.

D. For large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following materials are acceptable:

1. STI SpecSeal lightweight mortar SSM22B or putty
2. Hilti FS635 Trowelable Firestop Compound
3. 3M Fire Barrier FS-195 Composite Sheet
4. Biofireshield K-10 & K2 mortar
5. Metacaulk Firestop Mortar

E. For fire-rated construction joints and other gaps with movement, the following materials are acceptable:

1. Hilti FS 601 Elastomeric Firestop Sealant
2. STI Pensil 300
3. 3M (Dow Corning Fire Stop Sealant 2000)
4. Fyre-Sil, Tremco, Inc.
5. Biofireshield, Biostop 700, Biostop 500+
6. Metacaulk 1000 & 1100

F. Provide a firestopping system with an "F" rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:

1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.

2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form release agent from concrete.

3.03 INSTALLING THROUGH-PENETRATION FIRESTOPS

A. General: Comply with the manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross sectional shapes and depths required to achieve fire ratings of designate through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
2. Apply materials so they contact and adhere to substrate 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.

3.04 INSTALLING FIRE RESISTIVE JOINT SEALANTS

A. General: Comply with the manufacturer's installation instructions and drawings pertaining to products and application indicated.

3.05 CLEANING

A. Clean off excess fill materials and sealant adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
SECTION 07910 - JOINT FILLERS AND GASKETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

A. The extent of each type of joint filler and gasket work is indicated on the drawings and by provisions of this section, and is hereby defined to include required fillers and gaskets not specified in other sections of these specifications.

B. The required applications of joint fillers and gaskets include, but are not necessarily limited to, the following general types and locations:

1. Joint fillers around penetrations of equipment and services through walls, floors and roofs.

1.03 SUBMITTALS:

A. Product Data:

1. Submit manufacturer's specifications, installation instructions and recommendations for each type of material required.

B. Samples:

1. Submit three, 12 inches long samples of each joint filler or gasket.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL:

A. Size and Shape: Provide sizes and shapes of units as shown or, if not shown, as recommended by manufacturer for joint size and condition shown. Where joint movement is a factor in a determination of size, consult with Architect to determine nature and magnitude of anticipated joint movements for the temperature and condition of project at time of installation.

B. Compressibility: Specified hardness and compressibilities
are intended to establish requirements for normal or average conditions of installation and use. Where a range of hardness or compressibility is available for a product, comply with manufacturer's recommendations for specific condition of use.

C. Color: Provide each concealed material in manufacturer's standard color which has best overall performance characteristics for application shown. Provide exposed materials in black, except where another color is indicated.

D. Compatibility: Before purchase of each filler or gasket material, confirm that it is compatible with substrate, sealants and other materials in joint system.

E. Adhesives: Pressure sensitive adhesives, compatible with each material in joint system may be applied (at installer's option) to one face of joint fillers and gaskets to facilitate installation and permanent anchorage. Do not allow adhesives to contaminate sealant bond surface (if any) in joint system.

2.02 CONCRETE CONTROL/EXPANSION JOINT FILLERS:

A. Bituminous and Fiber Joint Filler:

1. Provide resilient and non-extruding type premolded bituminous impregnated fiberboard units complying with ASTM D 1751, FS HH-F-341, Type 1 and AASHO M 213.

2. Provide one of the following products:
   a. Flexcell-Knight-Celotex Corporation
   b. Expansion-Joint Filler; BASF/Sonneborn
   c. FF-14. Asphalt Fiber-Board; Progress Unlimited
   d. Fibre Expansion Joint; W.R. Meadows, Inc.
   e. Conflex Fiber Expansion Control Joint Filler, JD Russell

2.03 CELLULAR/FOAM EXPANSION JOINT FILLERS:

A. Closed-Cell PVC Joint Filler:

1. Provide flexible expanded polyvinyl chloride complying with ASTM D 1667. Grade VE 41 BL (3.0 psi compression deflection); except provide higher compression deflection grades as may be necessary to withstand installation forces.

2. Provide one of the following products:
a. FF2 PVC: Progress Unlimited, Inc.
b. Vinyl "U" 1000 Series: Williams Products, Inc.

2.04 GASKETS:

A. Molded Neoprene Gasket:

1. Provide extruded neoprene or EPDM gaskets complying with ASTM D 2000, Designation 2BC 415 to 3BC 620, black (40 to 60 Shore A durometer hardness); of the profile shown or, if not shown, as required by the joint shape, size and movement characteristics to maintain a watertight and airtight seal.

2. Provide products by one of the following manufacturers:
   a. D.S. Brown Company
   b. Hohmann & Barnard, Inc.
   c. Kirkhill Rubber Company
   d. Progress Unlimited, Inc.
   e. JD Russell
   f. Williams Products, Inc.

2.05 MISCELLANEOUS MATERIALS:

A. Oakum Joint Filler:

1. Provide untreated hemp or jute fiber rope, free of oil, tar and other compounds which might stain surfaces, contaminate joint walls or not be compatible with sealants.

B. Fire-Resistant Joint Filler:

1. Glass fiber or other inorganic non-combustible fiber formed with minimum of binder into resilient joint filler strips or blankets of sizes and shapes indicated, recommended by manufacturer specifically for increasing fire resistance or endurance of joint systems of type indicated, for service temperatures up to 2300 degrees F, 80% (min.) recovery 50% compression.
3.01 INSPECTION:

A. Installer must examine joint surfaces of units to receive fillers or gaskets and conditions under which the work is to be performed and notify the General Contractor, in writing, of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION:

A. Comply with manufacturer's instructions and recommendations for installation of each type of joint filler or gasket required, unless more stringent requirements are shown or specified.

B. Set units at proper depth of position in joint to coordinate with other work, including installation of bond breakers, backer rods, and sealants. Do not leave voids or gaps between ends of joint filler units.

C. Recess exposed edges or faces of gaskets and exposed joint filler slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will not protrude from joints.

D. Bond ends of gaskets together with adhesive or by means as recommended by manufacturer to ensure continuous watertight and airtight performance. Miter-cut and bond ends at corners except where molded corner units are provided.

END OF SECTION 07910
PART 1 - GENERAL

1.01 RELATED DOCUMENTS:
   A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:
   A. The extent of each type of sealant and caulking work is indicated on the drawings and by provisions of this section.

   B. The required applications of sealants and caulking include, but are not necessarily limited to, the following general locations:

      1. Flashing reglets and retainers.
      3. Interior sound-sealed and air-sealed joints.
      4. Flooring joints.
      5. Isolation joints, between structure and other elements.
      6. Joints at penetrations of walls, decks and floors by piping and other services and equipment.
      7. Joints between items of equipment and other construction.
      8. Joints between dissimilar materials.

1.03 QUALITY ASSURANCE:
   A. Manufacturers: Firms with not less than 5 years of successful experience in production of types of sealants and caulking compounds required for this project.

      1. Obtain elastomeric sealants from a manufacturer which will, upon request, send a qualified technical representative to the project site for purpose of advising installer on proper procedures for use of products.

   B. Installer: A firm with a minimum of (5) five years of successful experience in application of types of materials required.
1.04 SUBMITTALS:

A. Product Data:
   1. Submit manufacturer's specifications, recommendations and installation and instructions for each type of sealant, caulking compound and associated miscellaneous material required.

B. Samples:
   1. Submit three, 12" long samples of each color required (except black) for each type of sealant and caulking compound exposed to view. Install sample between two strips of material similar to or representative of typical surfaces where compound will be used, held apart to represent typical joint widths.

1.05 JOB CONDITIONS:

A. Pre-Installation Meeting: At General Contractor’s direction, installer, sealant manufacturer's technical representative, and other trades involved in coordination with sealant work shall meet with General Contractor at project site to review procedures and time schedule proposed for installation of sealants in coordination with other work. Review each major sealant application required on project.

B. Weather Conditions: Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended temperature range for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Where joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in lower third of the manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures. Coordinate time schedule with the General Contractor to avoid delay of project.

C. Statement of Non-Compliance: Where it is necessary to proceed with installation of sealants or caulking compound under conditions which do not fully comply with requirements (because of time schedule or other reasons which the General Contractor determines to be crucial to project), prepare written statement for
Owner's record (with copy to Architect) indicating the nature of non-compliance, reasons for proceeding, precautionary measures taken to ensure best possible work and names of individuals concurring with decision to proceed with installation.

1.06 SPECIAL PROJECT WARRANTY (GUARANTEE):

A. Sealant Warranty: Provide written warranty, signed by the contractor/installer, agreeing to, within warranty period of 10 years (or maximum warranty provided by manufacturer for polyurethane sealants) after date of substantial completion, replace/repair defective materials and workmanship defined to include: Instances of significant leakage of water or air; failures in joint adhesion, material cohesion, abrasion resistance, strain resistance or general durability; failure to perform as required and the general appearance of deterioration in any other manner not clearly specified in manufacturer's published product literature as an inherent characteristic of the sealant material. Warranty includes responsibility for removal and replacement of other work (if any) which conceals or obstructs the replacement of sealants.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL:

A. Colors: Provide black or other natural color where no other standard or custom color is available. Where material is not exposed to view, provide manufacturer's standard color which has best overall performance characteristics for application shown.

1. Provide manufacturer's standard colors as selected by Architect from manufacturer's standard colors.

B. Hardnesses shown and specified are intended to indicate general range necessary for overall performance. Consult manufacturer’s technical representative to determine actual hardness recommended for conditions of installation and use. Upon request, Architect will furnish information concerning anticipated joint movement related to actual joint width and installation temperature. Except as otherwise indicated or recommended, provide compounds within the following range of hardness (Shore A, fully cured, at 75 degrees F.).
1. 5 to 20 for high percentage of movement and minimum exposure to weather and abrasion (including no exposure to vandalism).

2. 15 to 35 for moderate percentage of movement and moderate exposure to weather and abrasion.

3. 30 to 60 for low percentage of movement and maximum exposure to weather and abrasion (including foot traffic on horizontal joints).

C. Modulus of Elasticity: For joints subjected to movement, either thermal expansion of dynamic movement, select sealants from among available variations which have lowest modulus of elasticity which is consistent with exposure to abrasion or vandalism. For horizontal joints subject to traffic, select sealants with high modulus of elasticity as required to withstand indentation by stiletto heels. Comply with manufacturer's recommendations where no other requirements are indicated.

D. Compatibility: Before selection and purchase of each specified sealant, investigate its compatibility with joint surfaces, joint fillers and other materials in joint system. Provide only materials (manufacturer's recommended variation of specified materials) which are known to be fully compatible with actual installation conditions as shown by manufacturer's published data or certification.

2.02 SEALANTS:

A. One Part Elastomeric Sealant (Silicone)

1. One component elastomeric sealant, complying with ASTM C 920, Class 25, Type NS (nonsag), unless Type S (self-leveling) recommended by manufacturer for the application shown.

a. Acceptable Standard

1. "Pecora 864 Architectural Silicone Sealant; Pecora Corp.
2. Dow Corning 791; Dow Corning Corp.
3. Silpruf; General Electric
4. Omniseal; Sonneborn Building Products, Inc.
5. Spectrem 2; Tremco Mfg. Co.
6. Sikasil WS 295; Sika Corp.
2. One-Component mildew resistant silicone sealant: (Around countertops and backsplashes and other wet interior locations).
   a. Acceptable Standard
      1. Rhodorsil 6B white; Rhone-Poulenc Inc.
      2. Dow Corning 786; Dow Corning Corp.
      3. Sanitary 1700; General Electric
      4. Sikasil GP; Sika Corp.

3. One Component high movement joints (+100/-50): Where locations of high movement are indicated.
   a. Dow Corning 790; Dow Corning Corp.
   b. Spectrem 1; Tremco
   c. Sikasil WS 290; Sika Corp.

B. Elastomeric Sealant (Polyurethane)

1. One component polyurethane sealant, complying with ASTM C 920, Type S, Grade NS, Class 25 (nonsag).
   a. Acceptable Standard
      1. Sonolastic NP 1; Sonneborn Building Products Inc.
      2. Dymonic; Tremco Mfg. Co.
      3. Dynatrol I; Pecora Corp.
      4. Vulkem 921; Mameco
      5. CS 2130; Hilti
      6. Sikaflex 1A; Sika Corp.
      7. Sikaflex 15LM; Sika Corp.

2. Two Component polyurethane sealant, complying with ASTM C 920, Type M, Grade NS, Class 25 (nonsag).
   a. Acceptable Standard
      1. Sonolastic NP 2; Sonneborn Building Products Inc.
      2. Dymeric; Tremco Mfg. Co.
      3. Dynatrol II; Pecora Corp.
      4. Vulkem 922; Mameco
      5. Sikaflex 2cNSEQ; Sika Corp.
C. One-part self-leveling polyurethane sealant (for traffic areas).

1. One Component polyurethane self-leveling sealant, complying with ASTM C 920, Type S, Grade P, Class 25.
   a. Acceptable Standard
      1. Sonolastic SL 1; Sonneborn Building Products Inc.
      2. NR-201 Urexpan; Pecora Corp.
      3. Vulkem 45; Mameco
      4. Sikaflex 1cSL; Sika Corp.

   a. Acceptable Standard
      1. Sonolastic SL 2; Sonneborn Building Products Inc.
      2. NR-200 Urexpan; Pecora Corp.
      3. Vulkem 245; Mameco
      4. THC900/THC901; Tremco
      5. Sikaflex 2cSL; Sika Corp.

D. Security Sealant (Polyurethane)

1. One component or two component polyurethane sealant, complying with ASTM C 920, Grade NS, Class 12.5, with a Shore A Hardness of 55.
   a. Acceptable Standard
      1. Dynaflex; Pecora Corp.
      2. Ultra; Sonneborn Building Products, Inc.

2.03 CAULKING COMPOUNDS:

A. Caulking Compounds: (Acrylic Latex Sealant)

1. Latex rubber modified, acrylic emulsion polymer sealant compound; manufacturer's standard, one part, nonsag, mildew resistant, acrylic emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent.
   2. Acceptable Standard
      a. Sonolac, Sonneborn Building Products Inc.
      b. Acrylic Latex Caulk 834, Tremco Inc.
      c. Acrylic Latex Caulk with Silicone, DAP
      d. AC-20, Pecora Corp.
2.04 MISCELLANEOUS MATERIALS:

A. Joint Cleaner: Provide type of joint cleaning compound recommended by sealant or caulking compound manufacturer, for joint surfaces to be cleaned.

B. Joint Primer/Sealer: Provide type of joint primer/sealer recommended by sealant manufacturer, for joint surfaces to be primed or sealed.

C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape where applicable.

D. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended for compatibility with sealant by the sealant manufacturer.

E. Provide size and shape of rod which will control joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize possibility of sealant extrusion when joint is compressed.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. The installer must examine joint surfaces, backing and anchorage of units forming sealant rabbet and condition under which sealant work is to be performed and notify the General Contractor in writing of conditions detrimental to proper completion of the work and performance by sealants. Do not proceed with sealant work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 SELECTION OF MATERIAL

A. Caulking compounds shall be used for interior nonmoving joints and at locations indicated.
B. One component elastomeric silicone sealants shall be used at exterior and interior joints where thermal or dynamic movement is anticipated including, but not limited to, the following locations:

1. Metal to metal joints.
2. Sheet metal flashing, coping, preformed metal caps, fascias, extenders, trim and panels.

C. One or two component elastomeric polyurethane sealants shall be used at exterior and interior joints where weatherproofing or waterproofing is required and at exterior joints between dissimilar materials including, but not limited to, the following locations:

1. Expansion and control joints.
2. Exterior side of hollow metal frames to adjacent materials.
3. Lintels and shelf angles to masonry construction.
4. Vertical interior expansion joints and horizontal interior control joints and expansion joints in the building.
5. Sealant in pipe sleeves where materials must perforate the floor slab.
6. Perimeter of floor slabs which abut vertical surfaces.
7. Exterior joints between dissimilar materials where the joining of the two surfaces leaves a gap between the meeting materials or components as may be dictated by the various methods of construction to make watertight.
8. Exterior locations which are noted "caulked" or "sealant" and not specifically listed herein or included in the work of other sections of the Specifications.
9. Interior joints between dissimilar materials where the joining of the 2 surfaces leave a gap between the meeting materials and components.

D. One or two part self-leveling polyurethane sealants shall be used for interior horizontal joints subject primarily to pedestrian traffic.

E. Security sealant shall be used in vertical control joints in the interior side of building.
3.03 JOINT SURFACE PREPARATION:

A. Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant or caulking compound.

B. For elastomeric sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with paragraph 4.3.9. of FS TT-S-00227 has successfully demonstrated that sealant bond is not impaired by coating or treatment. If laboratory test has not been performed or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.

C. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5% solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

D. Roughen joint surfaces on vitreous coated and similar non-porous materials, where sealant manufacturer's data indicated lower bond strength than for porous surfaces. Rub with fine abrasive to produce a dull sheen.

3.04 INSTALLATION:

A. Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

B. Prime or seal joint surfaces where shown or recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

C. Install sealant backer rod for liquid sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for the application shown.
D. Install bond breaker tape where shown and where required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

E. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

F. Install sealants to depths as shown or if not shown as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead.

1. For slabs and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width and neither more than 5/8" deep nor less than 3/8" deep.

2. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.

3. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75% to 125% of joint width.

G. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces or to migrate into voids of adjoining surfaces including exposed aggregate panels and similar rough textures. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces but either primer/sealer or the sealant/caulking compound.

H. Remove excess and spillage of compounds promptly as the work progresses. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage without damage to adjoining surfaces or finishes.
3.05 CURE AND PROTECTION:

A. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability. Do not cure in a manner which would significantly alter materials modulus of elasticity or other characteristics.

B. Installer shall advise the General Contractor of procedures required for curing and protection of sealants and caulking compounds during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of Owner's acceptance.

END OF SECTION 07920
SECTION 08112 - HOLLOW METAL WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

A. The extent of hollow metal work is shown on the drawings and schedules.

B. This section includes hollow metal doors and pressed steel frames for doors and related openings.

C. Related Work Specified Elsewhere:
   1. Glass and Glazing: Section 08800.
   2. Fire Rated Glass: Section 08810

1.03 QUALITY ASSURANCE:

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.

B. Fire-rated door assemblies shall be Underwriter Laboratory.: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E 152 "Standard Methods of Fire Tests for Door Assemblies". All metal labels to be riveted to door and frames mylar labels not acceptable.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications for fabrication and installation, including data substantiating that products comply with requirements.
B. Shop Drawings: Submit shop drawings for the fabrication and installation of hollow metal work. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections.

1. Provide a schedule of doors and frames using same reference numbers for details and openings as those on the contract drawings.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.

B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided the finish items are equal in all respects to new work and acceptable to the Architect; otherwise remove and replace damaged items as directed.

C. Store doors and frames at the building site under cover. Place units on at least 4" high wood sills or on floors in a manner that will prevent rust and damage. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber. If the cardboard wrappers on doors become wet, remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Hot-Rolled Steel Sheets and Strips: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM 568.

B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, G90 zinc coating, mill phosphatized.
D. Supports and Anchors: Fabricate of not less that 16 gage sheet metal. Galvanize after fabrication units to be built into exterior walls, complying with ASTM A 153, Class B.

E. Inserts, Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

F. Shop-Applied Paint: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as base for specified finish paints on steel surfaces.

2.02 FABRICATION, GENERAL:

A. Fabricate hollow metal units to be rigid, neat in appearance, and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment to assure proper assembly at the project site. Weld exposed joints continuously; grind, dress, and make smooth, flush, and invisible. Metallic filler to conceal manufacturing defects is not acceptable.

B. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.

C. Finish Hardware Preparation:

1. Prepare hollow metal units to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling, and tapping in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.

2. Reinforce hollow metal units to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
3. Locate finish hardware as shown on final shop drawings, or if not shown, in accordance with "Recommended Locations for Builder's Hardware", published by Door and Hardware Institute.

D. Shop Painting:
   1. Clean, treat and paint exposed surfaces of fabricated hollow metal units, including galvanized surfaces.
   2. Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before application of paint.
   3. Apply pretreatment to cleaned metal surfaces, using cold phosphate solution (SSPC-PT-2), hot phosphate solution (SSPC-PT4) or basic zinc chromate-vinyl butyral solution (SSPC-PT3).
   4. Apply shop coat or prime paint within time limits recommended by pretreatment manufacturer. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 2.0 mils.

E. Manufacturer: Provide hollow metal work by one of the following:
   1. Ceco Door Products
   2. Curries
   3. Steelcraft/Div of Ingersol Rand

2.03 DOORS:

A. General:
   1. Provide flush design doors, 1-3/4" thick, seamless hollow construction, unless otherwise indicated. Bevel both vertical edges 1/8" in 2".
   2. Insulated doors: Interior core of doors to be foamed in place, closed cell, polyurethane foam chemically bonded to door face sheets. Voids in foam will not exceed 1/2" in any direction. Compressive strength of polyurethane to be minimum of 20 PSI. Foam density not less than 1-8 PCF. Polystyrene core doors not acceptable. Doors to have R factor of not less than 14.81 U factor of .068.
B. Exterior Doors:

1. Fabricate exterior doors of 2 outer, galvanized, stretcher-level steel sheets not less than 16 gage. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges except around glazed or louvered panel inserts. Provide weep hole openings in the bottom of doors to permit escape of entrapped moisture.

2. Reinforce inside of doors with vertical galvanized sheet steel sections not less than 22 gage. Space vertical reinforcing 6" o.c. and extend full door height. Spot-weld at not more than 5" o.c. to both face sheets.

   a. Continuous truss-form inner core of 28 gage galvanized sheet steel reinforcing may be provided as inner reinforcement in lieu of above. Spot-weld truss-form reinforcement 3" o.c. vertically and horizontally over entire surface of both sides.

3. Reinforce tops and bottoms of doors with 16 gage horizontal steel channels welded continuously to outer sheets. Close top and bottom edges to provide weather seal as integral part of door construction or by addition or inverted steel channels.

C. Interior Doors:

1. Fabricate interior doors of two outer, cold-rolled, stretcher-leveled steel sheets not less than 16 gage. Construct doors with smooth, flush surfaces, without visible joints or seams on exposed faces or stile edges except around glazed or louvered panel inserts.

2. Reinforce inside of doors with vertical, hot-rolled, not less than 22 gage steel sections. Space vertical reinforcing 6" o.c. and extend full door height. Spot weld at not more than 5" o.c. to both face sheets.

   a. Continuous truss-form inner core of 28 gage sheet metal reinforcing may be provided as inner reinforcement in lieu of above. Spot-weld truss-form reinforcement 3" o.c. vertically and horizontally over entire surface of both sides.
3. Reinforce tops and bottoms of doors with 16 gage, horizontal steel channels, welded continuously to outer sheets.

D. Finish Hardware Reinforcement: Reinforce doors for required finish hardware as follows:

1. Hinges: Steel plate 3/16" thick x 1-1/2" wide x 6" longer than hinge, secured by not less than 6 spot-welds.

2. Mortise Locksets and Dead Bolts: 14 gage steel sheet, secured with not less than two spot-welds.

3. Cylinder Locks: 12 gage steel sheet, secured with not less than two spot-welds.

4. Flush Bolts: 12 gage steel sheet, secured with not less than two spot-welds.

5. Surface-Applied Closers: 12 gage steel sheet, secured with not less than six spot-welds.

6. Plush Plates and Bars: 16 gage steel sheet (except when through bolts are shown or specified), secured with not less than two spot-welds.

7. Surface Panic Devices: 14 gage sheet steel (except when through bolts are shown or specified), secured with not less than two spot-welds.

2.04 FRAMES:

A. Provide hollow metal frames for doors, side-lights, borrowed lights, and other openings of sizes and profiles as indicated.

B. Fabricate frames of full-welded unit construction with corners mitered, reinforced, continuously welded full depth and width of frame, unless otherwise indicated.

1. Knock-down type frames are not acceptable.

C. Form frames of galvanized steel sheets for exterior and either cold or hot-rolled sheet steel for interior.

1. Gage: Not less than 14, for exterior openings up to and including 4'-0" wide.
2. Gage: Not less than 14, for interior openings up to and including 4'-0" wide.

3. For openings over 4'-0" wide, increase thickness by at least two standard gages.

D. Finish Hardware Reinforcement: Reinforce frames for required finish hardware as follows:

1. Hinges and Pivots: Steel plate 3/16" thick x 1-1/2" wide x 6" longer than hinge, secured by not less than six spot-welds.

2. Strike Plate Clips: Steel plate 3/16" thick x 1-1/2" wide x 3" long.

3. Surface-Applied Closers: 12 gage steel sheet, secured with not less than six spot-welds.

4. Concealed Closers: Removable steel access plate, 12 gage internal reinforcement of size and shape required, and enclosing housing to keep closer pocket free of mortar or other materials.

E. Head Reinforcing: Where installed in masonry, leave vertical mullions in frames open at top for grouting.

F. Jamb Anchors: Furnish jamb anchors as required to secure frames to adjacent construction, formed of not less than 18 gage galvanized steel.

1. Masonry Construction: Adjustable, flat, corrugated or perforated T-shaped to suit frame size, with leg not less than 2" wide by 10" long. Furnish at least three anchors per jamb up to 7'-6" height; four anchors up to 8'-0" jamb height; one additional anchor for each 24" or fraction thereof over 8'-0" height.

2. Metal Stud Partitions: Insert type with notched clip to engage metal stud, welded to back of frames. Provide at least four anchors for each jamb for frames up to 7'-6" in height; five anchors up to 8'-0" jamb height; one additional anchor each 24" or fraction thereof over 8'-0" height.
3. In-Place Concrete or Masonry: Anchor frame jambs with minimum 3/8" concealed bolts into expansion shields or inserts at 6" from top and bottom and 26" o.c., unless otherwise shown. Reinforce frames at anchor locations. Apply removable stop to cover anchor bolts unless otherwise indicated.

G. Floor Anchors: Provide floor anchors for each jamb and mullion which extends to floor, formed of not less than 14 gage galvanized steel sheet as follows:

1. Monolithic Concrete Slabs: Clip type anchors with two holes to receive fasteners, welded to bottom of jambs and mullions.

H. Head Anchors: Provide two anchors at head of frames exceeding 42" wide for frames mounted in steel stud walls.

I. Head Strut Supports: Provide 3/8" x 2" vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable bolted anchorage to frame jamb members.

J. Structural Reinforcing Members: Provide as part of frame assembly, where indicated at mullions, transoms, or other locations which are to be built into frame.

K. Head Reinforcing: For frames over 4'-0" wide in masonry wall openings, provide continuous steel channel or angle stiffener not less than 12 gage for full width of opening welded to back of frame at head.

L. Spreader Bars: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.

M. Rubber Door Silencers: Except on weatherstripped doors, drill stops to receive three silencers on single-door frames and four silencers on double door frames. Install plastic plugs to keep holes clear during construction.

N. Plaster Guards: Provide 26 gage steel plaster guards or dust cover boxes, welded to frame at back of finish hardware cutouts where mortar or other materials might obstruct hardware installation.
2.05 STOPS AND MOLDINGS:

A. Provide stops around glazed panels in hollow metal units and in frames to receive doors where indicated.

B. Form fixed stops integral with frame, unless otherwise indicated.

C. Provide removable stops and molds where indicated or required, formed of not less than 20 gage steel sheets matching steel on frames. Secure with countersunk machine screws spaced uniformly not more than 12 o.c.. Form corners with butted hairline joints.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Installer must examine substrate and conditions under which hollow metal work is to be installed and must notify Contractor, in writing, of any conditions detrimental to proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION:

A. Install hollow metal units and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

B. Setting Masonry Anchorage Devices:

1. Provide masonry anchorage devices where required for securing hollow metal frames to in-place concrete or masonry construction.

2. Set anchorage devices opposite each anchor location, in accordance with details on final shop drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.

3. Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so indicated on final shop drawings.
C. Placing Frames:

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

2. Protective Coating: In masonry walls, protect inside (concealed) faces of door frames using fibered asphalt emulsion coating. Apply approximately 1/8" thick over shop primer and allow to dry before handling.

3. In masonry construction, building-in of anchors and grouting of frames is included in Section 04300 of these specifications.

4. At in-place concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.

5. Place frames at fire-rated openings in accordance with NFPA Standard No. 80.

6. Make field splices in frames as detailed on final shop drawings, welded and finished to match factory work.

7. Remove spreader bars only after frames or bucks have been properly set and secured.

D. Door Installation:

1. Fit hollow metal doors accurately in their respective frames with the following clearances:

   a. Jambs and Head: 3/32".
   b. Meeting Edges, Pairs of Doors: 1/8".
   c. Bottom: 1/4" at threshold or carpet.
   d. Bottom: 1/4" to threshold or tile.
   e. Head: 1/8’’ to bottom of head or transom panel.

2. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

3. Finish Hardware installation is specified in Section 08710.
3.03 ADJUST AND CLEAN:

A. Final Adjustments: Check and re-adjust operating finish hardware items in hollow metal work just prior to final inspection. Leave work in complete and proper operating conditions. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise unacceptable.

B. Prime Coat Touch-Up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

END OF SECTION 08112
PART 1. GENERAL

1.1 SECTION INCLUDES: Wood doors non-rated and fire-rated
   A. Solid core flush wood doors

1.2 RELATED SECTIONS
   A. Section 08112 – Hollow metal work
   B. Section 08710 – Finish hardware

1.3 REFERENCES AND REGULATORY REQUIREMENTS
   A. ASTM E152 - Methods of Fire Tests and Door Assemblies.
   B. NFPA 252 - Standard Methods for Fire Assemblies.
   C. UBC 7-2-1994
   D. UBC 7-2, 1997
   E. MBC 2009
   F. UL 10 (c) - Fire Tests for Door Assemblies - Positive Pressure
   G. UL 10 (b) - Fire Tests for Door Assemblies - Neutral Pressure
   H. NFPA 80 - Fire Doors and Windows.
   I. Quality Standards:
      1. WDMA Industry Standard I.S. 1A-04
      2. ANSI A115. W Series, Wood Door Hardware Standards.
         (American National Standard Institute)
   J. Labeling Agencies
      1. Intertek Testing Services-Warnock Hersey (ITS-WH)
      2. Underwriters Laboratories (UL)

1.4 SUBMITTALS
   A. Shop drawings: Indicate location, size, and hand of each door; elevation of each kind of door; location and extent of hardware blocking; and other pertinent data.
      1. Indicate dimensions and locations of mortises and holes for hardware.
      2. Indicate dimensions and locations of cutouts.
      3. Indicate requirements for veneer matching.
      4. Indicate doors to be factory finished and finish requirements.
      5. Indicate fire ratings for fire doors.
   B. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
      1. Faces for Factory Finished doors: Show the full range
C. Samples for Verification:
   1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide one piece of the expected finished work.

1.5 QUALITY ASSURANCE

A. Source limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality standard: Comply with WDMA I.S.1-A 04

C. Fire-rated Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UBC 7-2-1997 (Positive Pressure)

1.6 DELIVERY STORAGE AND HANDLING AND SITE CONDITIONS

A. Deliver, store, protect and handle products under provisions of WDMA.

B. Package doors individually and wrap bundles of doors. Inspect for damage. Do not store in damp or wet areas. HVAC systems should be operating and balanced prior to arrival of doors. Acceptable humidity shall be no less than 25% nor greater than 55%.

C. Certain wood species are light sensitive. Protect doors from exposure to natural and artificial light after delivery.

1.7 WARRANTY

A. Provide manufacturer's warranty for Interior Solid Core Doors:
   1. Full Lifetime Warranty
PART 2. PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:
   1. Flush wood doors:
   2. Or Equal Products by:
      a. Algoma Hardwoods, Inc.
      b. Eggers Industries
      c. Oshkosh Door Company
      d. Mohawk Flush Doors – Masonite Company

B. Substitutions allowed only with written approval by architect prior to bid date.

2.2 DOOR CONSTRUCTION, GENERAL

A. WORKMANSHIP
   1. Comply with WDMA I.S. 1A-04

B. PERFORMANCE STANDARD
   1. Comply with WDMA I.S. 1A-04 Extra Heavy Duty

C. DOORS FOR TRANSPARENT FINISH:
   1. Grade: Premium, with A Grade Faces
   2. Wood veneer Species and Cut: Plain sliced red oak
   3. Match between veneer leaves: Book match
   4. Assembly of spliced veneers: Running
   5. Pair and Set match: Provide for doors hung in same opening or separated only by mullions.
   6. Door with Transom: Continuous match

D. DOORS FOR OPAQUE FINISH:
   1. Medium Density Overlay

E. Interior Veneer-faced doors:
   1. Stiles and rails bonded to core, then entire unit abrasive planed before veneering.
F. Rating: Positive pressure Category A (concealed intumescent).

2.3 SOLID-CORE DOORS

A. NON-FIRE RATED WOOD DOORS

1. Non-rated and 20-minute rated
   a. LD-2 Particleboard, PC-5
   b. Structural Composite Lumber, SCLC-5
   c. Stave lumber core, SLC-5

2. Provide manufacturers standard laminated-edge construction with improved screw-holding capability and split resistance.

3. 20-minute rated pairs:
   a. Provide with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.
   b. As required by manufacturer to permit positive pressure “S” label per Category H.

B. FIRE RATED WOOD DOORS

1. Manufacturer’s standard mineral-core construction as needed to provide fire rating indicated.

2. Blocking: provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware for surface applied hardware.

3. Provide manufacturers standard laminated-edge construction with improved screw-holding capability and split resistance that are labeled and listed to provide fire rating indicated.


2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated,
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FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

with the following uniform clearances and bevels, unless otherwise indicated:

1. WDMA prefit clearances for factory fit doors
2. NFPA 80 for fire rated doors
3. Manufacturers hardware templates

B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standard for kind(s) of doors(s) required.

1. Light openings: Trim openings with moldings of material and profile indicated.
2. Louvers: Factory install louvers in prepared openings.

D. Apply appropriate labels.

2.5 FACTORY FINISH

A. General: Comply with WDMA finish requirements.

B. Finish doors at factory.

C. Transparent Finish:
1. Finish: WDMA TR-6 catalyzed polyurethane.
2. Staining: As selected from manufacturers standard colors.

D. Factory finished doors to be installed just prior to substantial completion.

2.6 FACTORY GLAZING

FLUSH WOOD DOORS 08210 - 5
2.7 ACCESSORIES

A. GLAZING STOPS
   1. Non-Rated:
      a. Wood, of the same species/compatible with door species.
   2. Fire-Rated:
      a. Veneer wrapped rolled steel, of same species as door facing.

B. APPLIED MOLDINGS:
   1. As selected from manufacturer’s standard profiles and install as detailed.
   2. Applied moldings to be affixed to the door without the use of nails or staples.

PART 3. EXECUTION

3.1 EXAMINATION

A. Examine doors and installed frames before hanging doors.
   1. Verify that frames comply with indicated requirements for type, size, location and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects prior to hanging.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, Refer to Division 8 Section 08710 “Finish Hardware.”

B. Manufacturer’s written instructions: Install doors to comply with manufacturer’s written instructions, referenced quality standard, and as indicated.
   1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
C. Align all doors for uniform clearance at each edge.

D. Factory finished doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Adjust all doors to swing and operate freely.

END OF SECTION 08210
SECTION 08710:  FINISH HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Work included:
1. Furnish hardware required to complete the work as shown on the drawings and as specified herein;
2. Furnish trim attachments and fastenings, specified or otherwise required, for proper and complete installation.
3. Furnish all items of Finish Hardware specified, scheduled, shown or required herein except those items specifically excluded from this section of the specification.

B. Related work:
1. Division 1 – General Requirements
2. Division 6 – Rough Carpentry
3. Division 6 - Finish Carpentry: Installation of Finish Hardware
4. Division 8 – Steel Doors and Frames
5. Division 8 – Wood Doors
6. Division 8 – Special Doors
7. Division 8 – All Glass Entrances and Storefronts
8. Division 8 – Aluminum Framed Entrances and Storefronts
9. Division 16 – Smoke Detection Systems
10.Division 16 – Security Access Systems

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere, unless specifically listed in the hardware sets:
1. Cabinet Hardware.
2. Signs, except as noted.
3. Folding partitions, except cylinders where detailed.
4. Sliding aluminum doors
5. Chain link and wire mesh doors and gates
6. Access doors and panels
7. Overhead and Coiling doors
1.2 CODES AND REFERENCES

A. Comply with the version year adopted by the Authority Having Jurisdiction:
   5. NFPA 105 - Installation of Smoke Door Assemblies.
   6. Current State Building Codes including Local Amendments.

B. Standards: All hardware specified herein shall comply with the following industry standards:
   1. ANSI/BHMA Certified Product Standards - A156 Series
   2. UL10C - Positive Pressure Fire Tests of Door Assemblies

1.3 DEFINITIONS

A. "Finish Hardware": Items required for swinging, sliding and folding doors, except special types of unique and non-matching hardware specified under door and frame Sections of these Specifications.

1.4 SYSTEM DESCRIPTION

A. Design requirements:
   1. Review of hardware requirements:
      a. It is imperative that the hardware supplier understands the full hardware requirements of this project. Many of the doors will be re-used on this project. All doors that will be reused must be verified for size, hand and hardware configuration / application. All doors that are being reused must be patched, filled, repaired and re-prepped for the new hardware items as required for hardware operation.
b. Hardware supplier shall verify all existing field conditions & existing door conditions and notify architect immediately if that which exists differs from that which is shown on drawings.

c. These specifications are prepared in accordance with the limited services for which the hardware specification writer was contracted. The hardware specification writer makes no representation that the interpretation of these documents will result in complete harmony of salvage door / hardware.

d. Salvage doors will be provided by owner.

e. All doors required to be labeled shall be set in labeled frames and identified with UL label and be provided with approved self-closing devices and positive latching hardware.

f. All designated exit doors shall be equipped with the required egress hardware.

g. Furnish hardware as scheduled without substitution, only alternates listed in part 2 products will be approved as equal.

h. Thoroughly review finish hardware schedule, comparing it with the floor plan, door schedule, and door details to verify hardware requirements, quantities, door swings, finishes, and sizes.

i. If an inconsistency or error in the proposed construction documents is suspected, the hardware supplier is to bring it immediately to the attention of the Architect. If the quantity of items is questioned, for bidding purposes, assume the higher quantity is required and price accordingly.

j. Architect’s review of Submittals is for design concept only, and does not relieve the Contractor of the responsibility to furnish sufficient material and functions required for a complete and code-worthy installation. Determination of all quantities is the responsibility of the Contractor.

B. Performance requirements:

1. Furnish finish hardware complying with the requirements of laws, codes, ordinances and guidelines of governmental authorities having jurisdiction:
c. NFPA 80 - Fire Doors and Windows.
e. NFPA 105 - Installation of Smoke Door Assemblies.
f. Current State Building Codes, Local Amendments.

1.5 Submittals:
A. Hardware Schedule
1. Submit number of Hardware Schedules as directed in Division 1.
2. Follow guidelines established in Door & Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule unless noted otherwise.
3. Schedule will include the following:
   a. Door Index including opening numbers and the assigned Finish Hardware set.
   b. Preface sheet listing category only and manufacturer's names of items being furnished as follows:

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>SPECIFIED</th>
<th>SCHEDULED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinges</td>
<td>Manufacturer A</td>
<td>Manufacturer B</td>
</tr>
<tr>
<td>Lock sets</td>
<td>Manufacturer X</td>
<td>Manufacturer X</td>
</tr>
<tr>
<td>Kick Plates</td>
<td>Open</td>
<td>Manufacturer Z</td>
</tr>
</tbody>
</table>

c. Hardware Locations: Refer DHI to Article 3.1 B.2 Locations.
d. Opening Description: Single or pair, number, room locations, hand, active leaf, degree of swing, size, door material, frame material, and UL listing.
e. Hardware Description: Quantity, category, product number, fasteners, and finish.
f. Headings that refer to the specified Hardware Set Numbers.
g. Scheduling Sequence shown in Hardware Sets.
h. Product data of each hardware item, and shop drawings where required, for special conditions and specialty hardware.
i. Electrified Hardware system operation description.
j. "Vertical" scheduling format only. "Horizontal" schedules will be returned "Not Approved."

k. Typed Copy.

l. Double-Spacing.

m. 8 1/2 x 11 inch sheets

n. U.S. Standard Finish symbols or BHMA Finish symbols.

B. Product Data:
1. Submit, in booklet form Manufacturers Catalog cut sheets of scheduled hardware.
2. Submit product data with hardware schedule.

C. Samples:
1. Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample, if required, of each type of exposed hardware unit, finished as required and tagged with full description for coordination with schedule.
2. Samples will be returned to the supplier. Units, which are acceptable and remain undamaged through submittal, review and field comparison procedures, may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

D. Submit to General Contractor/Construction Manager, the factory order acknowledgement numbers for the various hardware items to be used on the project. The factory order acknowledgement numbers shall help to facilitate and expedite any service that may be required on a particular hardware item. General Contractor/Construction Manager shall keep these order acknowledgement numbers on file in the construction trailer.

1.6 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the requirements and the methods needed for proper performance of the work of this Section.
B. Supplier qualifications:
   1. A recognized architectural finish hardware supplier.
   2. Continuously in business of finish hardware supply for
      not less than 5 years.

C. Provide the service of an Architectural Hardware
   Consultant to:
   1. Be available for consultation with the Architect at no
      additional cost to the Owner during progress of
      construction, and:
      a. Inspect installation of all finish hardware items;
      b. Make all minor adjustments required; and
      c. Report to the Architect on completeness of the
         installation.
   2. The hardware consultant may be an employee of the
      supplier.

D. Installer qualifications: Employ a competent hardware
   installer with at least five (5) years experience
   installing commercial grade hardware similar to that
   proposed for the Work.

E. Source limitations: Obtain each type of hardware (latch
   and lock sets, hinges, closers, etc.) from a single
   manufacturer, although several may be indicated as
   offering products complying with requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Provide adequate, safe and secure storage for hardware
   items during the building process.

B. Product identification:
   1. Tag and mark each item separately in manufacturers
      unopened package, identifying it by product number and
      architectural opening number, as listed in the
      approved Finish Hardware Schedule.
   2. Include instructions, templates, and fasteners needed
      for installation.
C. Deliver individually packaged hardware items on a vehicle operated by a direct employee of the Hardware Supplier. Contractor shall immediately, and in the presence of the Hardware Supplier, inventory the contents of the delivery.

D. Hardware supplier: Furnish finish hardware items directly to the factory or mill for factory-installation, where required.

1.8 PROJECT CONDITIONS

A. Provide a secure, well lit, dry storage area for the sole purpose of storing finish hardware. Prohibit access to all jobsite personnel, except those employed by the installing contractor.

1.9 WARRANTY

A. Manufacturer’s warranty:
   1. Standard manufacturer’s warranties apply for products listed in Part 2 products.
   2. Refer to Division 1 for further warranty requirements.

B. During the warranty period, replace defective work, including labor, materials and other costs incidental to the work. Replace work found to be defective as defined in the General Conditions.

C. Failures due to defective materials or workmanship to include, but not to be limited to:
   1. Failures in operation of any operating component;
   2. Defects which contribute to unsightly appearance, potential safety hazard, or potential untimely failure of the products furnished under this Section.

PART 2 - PRODUCTS

2.1 GENERAL

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each finish hardware item is indicated in the Finish Hardware Schedule at the end of this Section.

FINISH HARDWARE 08710 - 7
B. Product designations:
   1. One or more manufacturers are listed for each hardware type required. Product listed is for basis of design. Only products listed in part 2 product descriptions will be allowed for substitution.

C. ANSI/BHMA designations:
   1. Used to describe hardware items, or to define quality or function. Provide products complying with these standards in addition to additional requirements of this Section.

D. Hand of door: Drawings show direction of slide, swing ("hand") of door leafs.

E. Hardware: Use hardware manufactured to conform to published templates and, generally, prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.

2.2 MATERIALS

A. Base metals:
   1. Manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially-recognized) quality than that specified for applicable hardware units by applicable ANSI A156 series standard for each type hardware item and with ANSI A156.18 for finish designations indicated.
   2. Do not furnish "optional" materials for those indicated, except as otherwise specified.

B. Fasteners:
   1. Furnish Phillips flat-head screws with each hardware item, unless otherwise indicated.
   2. Exposed screws: Match finish of hardware (even where noted to be "prepared for paint").
   3. Use concealed fasteners for hardware units which are exposed when door is closed, except where no standard units of type specified are available with concealed fasteners.
4. Do not use thru-bolts where bolt head or nut on opposite face would be exposed.

5. Where adequate reinforcement is not feasible, thru-bolting would only be acceptable if through sleeves, or if sex-screw fasteners are used.

C. Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

2.3 MANUFACTURED UNITS, GENERAL

A. Reference standards:
   1. Comply with ANSI A156 current series for each product type.

B. Hardware finishes:
   1. Materials and Finishes Standard: Comply with ANSI A156.18. Finish designations used in schedules are listed, therein.
   2. Provide matching finishes for hardware units at each door, unless otherwise indicated.
   3. Match the color and texture of hardware items to manufacturer's standard finish for the latchset, lockset, or push-pull unit.
   4. Provide quality of finish, including thickness of plating or coating, composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than that specified or described by referenced standards.

C. Hardware for fire-rated openings:
   1. Comply with NFPA 80
   2. Tested and listed by Underwriters Laboratory (UL), or Factory Mutual (FM) for type, size and use of door, and complying with requirements of door and door frame label.
   3. Provide UL or FM label on door indicating "Fire door to be equipped with fire-exit hardware".
   4. Provide UL or FM label on exit device indicating "Fire Exit Hardware".

FINISH HARDWARE
2.4 PRODUCTS

A. Hinges:

1. Continuous Hinges:
   a. Continuous shall be Heavy Duty Geared type hinges with 400lb rating.
   b. ANSI/BHMA A156.26 -Grade 1.
   c. Fire-rating: "WHI-listed" or "UL-listed" as necessary
   d. Placement of fire label will be on top of the door at cont. hinge locations.
   e. Provide hinge filler plates to fill existing hinge preps.
   f. Undersize doors according to hinge clearance requirements.
   g. Furnish power transfers as specified.
   h. Acceptable manufacturer’s: PBB, IDC

2. Butt Hinges:
   a. ANSI A156.1 - for commercial quality.
   b. Provide only template-produced units.
   c. All butt hinges to be ball bearing-5 knuckle type Standard or Heavy Weight as specified.
   d. Hinges at exterior doors shall be of non-ferrous material.
   e. All hinges shall be provided Non-removable (NRP)
   f. Size and number of hinges as specified; otherwise according to hinge manufacturer’s recommendation for door size and weight.
   g. Acceptable products: PDQ, Bommer, IDC

B. Lock Cylinders and Keying:

1. General:
   a. Supplier shall meet with Owner and Architect to finalize keying direction and furnish a complete key schedule. The key schedule shall include keysets, marks and key schedule corresponding to each opening.

2. Cylinders:
   a. Type: Mortise or rim-type as required by function of locking device.
   b. Provide screw on cams or tail piece as required.
c. Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver.

d. Provide solid machined cylinder rings with tension spring to resist wrenching of cylinder. Length, finish and size as required.

e. Provide cylinder(s) and core(s) as required by function for each locking device.

3. System:

a. Provide temporary brass construction cores for each cylinder provided.

b. Unless otherwise indicated, provide Combined GM final cores keyed to owners’ master key system.

4. Keying:

a. Deliver keys and final cores to the hardware installation Contractor for final installation, when directed by the Owner.

b. Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.

c. Key material: Nickel silver

d. Key quantity:

(1) Two (2) change keys for each lock; Two (2) core keys total.

C. Locksets:

1. Mortise Locks

a. Comply with ANSI A156.13 - 1987, Grade 1 criteria for mortise locks

b. Function: Indicated in the hardware sets.

c. Lockset case shall to be non-handed.

d. Lockset shall accept SFIC 7 pin cores.

e. Lock shall be built in the USA.

f. Trim: Stainless Steel, PJEW lever-type equal to PDQ.

g. Acceptable products: PDQ MR, MBS R series, SDC 7000 Series

D. Exit devices:

1. General:

a. Comply with ANSI A156.3, Grade 1, Types 1, 4, and 28 criteria for products
b. At fire doors:
   (1) Provide UL or FM label on exit device indicating "Fire Exit Hardware", where appropriate.
   (2) Mount exit device using sex-bolts on labeled wood doors.

2. a. Type: Flat, push-bar type with noise deadening.
   b. Provide dead-locking latch bolts.
   c. Provide operational trim as specified.
   d. Function indicated in the hardware sets.
   e. Provide strike and brackets as required for the frame application.
   f. Acceptable products: PDQ 6000, SDC6000

E. Door closers:
1. General:
   a. ANSI A156.4 - 1986 Grade 1 criteria and FAR 52.208-9, Contractor Use of Mandatory Sources of Supply.
   b. All closers shall be the products of one manufacturer.

2. Description:
   a. Full rack-and-pinion type with Cast Iron Body.
   c. Closer body: Non-handed, multi-size spring power with ADA capability.
   d. With three non-critical V valves and hex key adjustment to independently regulate sweep latch speed and backcheck.
   e. Provide mounting brackets necessary to clear sound seals and weatherstrip.
   f. Enclose in a full, molded cover.
   h. Provide drop plates or special brackets for proper mounting.
   i. Pressure Relief Valves will NOT be accepted on Door Closers.
   j. Provide Barrier Free power setting as required by ANSI A117.1
   k. Where SCS is specified, furnish a Stainless Steel swivel snubber. Stationary spring nub, rubber grommets and studs will not be accepted.
   l. Acceptable products: PDQ 7000, IDC 44CI
F. Stops:
1. General:
   a. ANSI A156.16 - 1989 Grade 1 criteria.
   b. Provide stops where scheduled, wall or floor, as opening conditions dictate, utilizing wall stops wherever possible.

2. Description:
   a. Wall stops: Cast brass, bronze or stainless steel. Concave wall stop to have stainless steel washer imbedded in rubber stop.
   b. Floor stops: Cast Stainless, brass or bronze, and plated as required.
   c. Make selection of floor stop height based upon floor conditions and door undercut.

3. Fasteners:
   a. Provide universal fastener pack to accommodate masonry, steel stud, wood, tile and drywall mounting.

4. Acceptable products: PDQ, Rixson, Hiawatha

G. Kick plates, mop plates and armor plates:

2. Description:
   a. Minimum .050" thick, B4E Bevel 4 edges.
   b. Dimensions:
      (1) Width: 1-1/2" less than door width to which they are to be applied.
      (2) Kick plate height: 10"

3. Mounting:
   a. **Install kick plates flush to bottom edge of door.**

4. Acceptable manufacturers: PDQ, Hiawatha

H. Sweeps and strips:
1. General:
   a. ANSI A156.21 - 1989, Grade 1 criteria.

2. Description:
   a. Flat profile.
   b. Dimensions: Appropriate to door opening size.
   c. Installation locations are scheduled.

3. Acceptable products: Reese, IDC, KN Crowder
I. Miscellaneous Hardware Equipment and Material:
   1. General:
      a. Provide items and types as specified.

2.5 OTHER MATERIALS

   A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

2.6 HARDWARE FINISHES

   A. General:
      1. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible and except as otherwise indicated.
      2. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening.
      3. In general, match items to the manufacturer's standard finish for the latch and lock set (or push/pull units if no latch/lock sets) for color and texture.
      4. Provide finishes matching those established by BHMA or, if none established, match the Architect's sample.
      5. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than that specified for the applicable units of hardware by referenced standards.
      6. Finish designations used in schedules and elsewhere listed in ANSI A156.18 "Materials and Finishes Standard", including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

   B. Provide the following hardware finishes, unless otherwise scheduled:
      Dull Chrome, Stainless Steel, and Aluminum color pallet.

FINISH HARDWARE 08710 - 14
C. Base material: Manufacturer’s standard high-carbon steel, brass, or bronze.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

A. General:
1. Install each item in its proper location firmly anchored into position, level and plumb, and in accordance with the manufacturer's recommendations.
2. Handing, hardware heights, locations, and degree of opening swing are indicated in the Drawings and Finish Hardware Schedule.
3. Mount finish hardware units:
   a. At recommended heights and locations as shown in approved finish hardware schedule, complying with requirements of the A.D.A., and pertinent provisions of the Building Code.
   b. To function at proper degree of opening of doors as indicated on approved finish hardware schedule.
   c. By manufacturer's template.
   d. Prior to final finishing of the door. Remove hardware to allow finishing of door, and permanently reinstall hardware upon completion of finishing operation.
3. Reinforce, where necessary, the substrate to assure proper attachment.
4. Drill and countersink units which are not factory-prepared for anchorage fasteners.
5. Space fasteners and anchors in accordance with industry standards.
6. Provide hinge filler plates to fill existing hinge preps.
7. Patch and repair any hinge, lock, closer or miscellaneous hardware preps on existing frames prior to hanging door and mounting new hardware.

B. Installing closers:
1. Mount closers per manufacturer's template, and secure the Architect’s approval of the closer installation.
2. The Contractor will be required to REPLACE doors onto which closers are improperly mounted at no additional cost to the Owner. Repair or patching of such doors will not be acceptable.

C. Installing Stops: Install all wall stops into reinforced wall or stud. Projection type wall stops (115) should be mounted 80” from finish floor, with sloped portion of the stop facing up / flat side down. Install floor stops out of the way foot traffic at a height high enough to accommodate any ramp or uneven floor condition.

D. Installing thresholds at exterior doors: Set in full bed of butyl-rubber, or polyisobutylene mastic sealant.

E. Installing weatherstrip: Install weatherstrip prior to installing closers, OH Stops or panic hardware. Template closers and panic devices from weatherstrip and install all closer / OH Stop shoe brackets and panic device strikes onto the weatherstrip without notching or cutting the weatherstrip.

F. Installing Sweeps: Install all sweeps on exterior side of opening.

3.4 FIELD QUALITY CONTROL

A. Inspection of final hardware installation: The Contractor, hardware suppliers, and Architectural Hardware Consultant (AHC) shall thoroughly check the quality of the installation and the functionality of each unit of finish hardware at all openings in the Work.
The Hardware Supplier shall forward a detailed written report of all operational or installation deficiencies to the Architect and Contractor.

3.5 CLEANING AND ADJUSTING

A. Check and adjust each item of hardware and each door upon completion of final installation. Verify proper function, and replace units which cannot be made to operate freely and smoothly, as intended for the application.

B. Clean adjacent surfaces soiled by hardware installation.

3.6 FINISH HARDWARE SCHEDULE

<table>
<thead>
<tr>
<th>Hardware Set 1</th>
<th>-Rim Panics x Mullion + Classroom Trim [Lock / Unlock] + Closer Stops</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 ea.</td>
<td>Continuous Hinge CG31L</td>
</tr>
<tr>
<td>2 ea.</td>
<td>Panic Device 6200RF x 6EW08PHL Classroom Trim</td>
</tr>
<tr>
<td>1 ea.</td>
<td>Keyed Mullion 9200MF-11(paint to match surrounding) USP</td>
</tr>
<tr>
<td>2 ea.</td>
<td>Mortise Cylinder I5307 x I5207-1 (08)</td>
</tr>
<tr>
<td>1 ea.</td>
<td>Rim Cylinder I5308 x I5207-1 (KM)</td>
</tr>
<tr>
<td>2 ea.</td>
<td>Closer 7101 BC SCS Stop (push side mount)</td>
</tr>
<tr>
<td>2 ea.</td>
<td>Floor Stop 220</td>
</tr>
<tr>
<td>2 ea.</td>
<td>Kickplate 98 10&quot; x 2&quot; LDW</td>
</tr>
<tr>
<td>1 set</td>
<td>Smoke Seal 797B</td>
</tr>
<tr>
<td>1 set</td>
<td>Flex Astragals 103C x 103C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hardware Set 2</th>
<th>-Rim Panics x Mullion + Classroom Trim [Lock / Unlock] + Closer &amp; Electric Hold Open</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 ea.</td>
<td>Continuous Hinge CG31L</td>
</tr>
<tr>
<td>2 ea.</td>
<td>Panic Device 6200RF x 6EW08PHL Classroom Trim</td>
</tr>
<tr>
<td>1 ea.</td>
<td>Keyed Mullion 9200MF-11(paint to match surrounding) USP</td>
</tr>
<tr>
<td>2 ea.</td>
<td>Mortise Cylinder I5307 x I5207-1 (08)</td>
</tr>
<tr>
<td>1 ea.</td>
<td>Rim Cylinder I5308 x I5207-1 (KM)</td>
</tr>
<tr>
<td>2 ea.</td>
<td>Closer 7101 BC EDA (push side mount)</td>
</tr>
<tr>
<td>2 ea.</td>
<td>Checkmate Electric Hold-open 99-926(pull side mount)</td>
</tr>
<tr>
<td>2 ea.</td>
<td>Kickplate 98 10&quot; x 2&quot; LDW</td>
</tr>
<tr>
<td>1 set</td>
<td>Smoke Seal 797B</td>
</tr>
<tr>
<td>1 set</td>
<td>Flex Astragals 103C x 103C</td>
</tr>
</tbody>
</table>

Note: Fire alarm power and termination required at this location. Requires 24V@ 1 amp per electric hold open device.
Hardware Set 3 - Existing door & hardware, new frame.

Verify existing opening and notify architect immediately if any conflicts exists.

Existing door and hardware to remain and installed in new hollow metal frame. Field verify existing door hinge & strike preps and fabricate new frame with matching hinge & strike preps. Size frame to existing door dimensions allowing for undercut, jamb and header clearances. Prep door & frame as needed to accept existing hardware.

Hardware Set 4 - Classroom Lock [Lock / Unlock] + Closer

3 ea. Butt Hinge 35STBB 4545 NRP
1 ea. Classroom Lock MR148 PJEW x SF7
1 ea. Closer 7101 BC PA Regular Arm (pull side mount) AL
1 ea. Wall / Floor Stop 102 / 220 -type as required
1 ea. Kickplate 98 10" x 2" LDW

Hardware Set 5 - Auto Flushbolts x Storeroom lock [Always Locked] + Closer Stop

6 ea Butt Hinge 35STBB 4545 NRP
1 set Auto Flushbolts 93102
1 ea Dust Proof Strike 909
1 ea Coordinator COORD00 x Req’d mounting brackets & filler Blk
1 ea Storeroom Lock MR115 PJEW x SF7L
2 ea Closer 7101 BC SCS Stop (push side mount) AL
2 ea Wall / Floor Stop 102 / 220 -type as required
2 ea Kickplate 98 10” x 2” LDW

Note: Verify existing opening and notify architect immediately if any conflicts exists.

New doors and hardware going into existing frame. Repair and Prep frame as needed to accept existing hardware.

END OF SECTION 08710
PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

   A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

   A. The extent of glass and glazing work is shown on the drawings.

   B. The required applications of glass and glazing include (but are not necessarily limited to) the following:
      
      1. Glazing interior openings.
      
      2. Glazing interior doors.

   C. Related Work Specified Elsewhere:
      
      1. Fire Rated Glass: Section 08810.

1.03 QUALITY ASSURANCE:


   B. Heat-Treated Glass Standard: Comply with the following as applicable.

      

   C. Insulating Glass Seal Standard: Comply with proposed standard ASTM E6-P-3, Test Methods P1 and P2.

   D. Manufacturers: Provide each type of glass and primary sealant/gasket from a single manufacturer with not less than 5 years of successful experience in the production of materials similar to those required.

   E. Installer (Glazier): Firm with not less than five (5) years of successful experience in glazing work similar to required work.
1.04 SUBMITTALS:

A. Product Data:

1. Submit manufacturer's product specifications, including documentation to compliance with requirements and instructions for handling, storing, installing, cleaning and protecting each type of glass and glazing materials.

B. Samples:

1. Submit two (2) samples of each type of glass and glazing material required, except for single-pane clear glass (including annealed and tempered). Submit 12" square glass samples and 12" lengths of installed (mocked-up) glazing materials.

   a. Submit insulating glass samples with completed edge-seal construction, but hermetic seal need not be maintained.

C. Warranties:

1. Warranty on Insulating Glass Units: Provide written warranty signed by fabricator (manufacturer) and countersigned by Contractor agreeing to within 10 years from date of substantial completion replace glass units with defective hermetic seal of air spaces (but not including that due to glass breakage); defined to include intrusion of dirt or moisture, internal condensation or fogging at temperature above -20 degrees F., deterioration of protected internal glass coatings resulting from seal failure, and other visual evidence of seal failure or performance; provide the manufacturer's printed and submitted instructions for handling, protecting, and maintaining units that have been adhered to during the warranty period.

2. Warranty on Laminated Glass: Provide written warranty signed by laminator (manufacturer) and countersigned by Contractor agreeing to within five (5) years after date of acceptance, replace glass units with defective lamination, defined to include evidence of delamination, changes in required strengths, transmittances, color, transparency, and other required performance.
1.05 PRODUCT HANDLING:
   A. Comply with manufacturer's instructions for shipping, handling, storing, and protecting glass and glazing materials. Exercise exceptional care to prevent edge damage to glass, and damage/deterioration to coatings on glass.

1.06 JOB CONDITIONS:
   A. Pre-Installation Meeting: Comply with General Requirements for pre-installation meeting of Glazier and other trades affected by glass installation.

   B. Weather: Do not proceed with glazing under adverse weather conditions. Install liquid sealants when temperatures are within lower or middle third of temperature range recommended by manufacturer.

PART 2 - PRODUCTS

2.01 GLASS

   A. Processed Glass:

      1. Tempered Glass: Heat treat to strengthen glass in bending to not less than 4.5 times annealed strength.
      2. Tong Marks: Wherever the glazing system sown for the installation of tempered glass will not conceal the tong marks inherent from normal tempering processes, provide tempered glass produced by special process which eliminates tong marks.

   B. Fabricated Products:

      1. Laminated Glass:

         a. Laminate units at the factory using manufacturer's standard pressure-plus-heat process to produce units of the required sizes, thicknesses, and component make-up to comply with the details and performance requirements shown and specified herein. Exercise extreme precautions and plant control in the laminating process to exclude dirt and other foreign matter from the lamination, and to eliminate voids and achieve complete lamination at each glass surface.

         b. Fabricate units to proper size and shape at the
factory so that no cutting, seaming, or nipping will be required for installation at the project site.

c. Provide the following type:
   (1) 1/4" Clear of Solexia (transparent) by PPG or equal consisting of:
       Exterior Glass: 1/8" tempered
       Laminating Film: 30 mils thick
       Interior Glass: 1/8" tempered glass

       A. "Solexia Glass"
       Visible light transmission 69%
       U value winter 0.47
       U value summer 0.50
       SHGC 0.49
       Shading Coefficient 0.57
       Outdoor visible light reflectance 13%
       Outdoor appearance: Light green color, low reflective glass product

       (2) ¼" clear:
       Exterior Glass: 1/8” clear plat tempered glass
       Laminating Film: 60 mils thick
       Interior Glass: 1/8” clear plate temp. glass

C. Design Thickness:
   1. Verify all glass thicknesses will comply with performance requirements.

D. Manufacturer of Glass: One of the following:
   1. Old Castle Building Envelope
   2. Saint-Gobain North America
   3. Pilkington North America, Inc.
   4. PPG Industries, Inc.
   5. Guardian Industries, North America
   6. Viracon, Inc., Owatonna, MN

E. Edges:
1. Polish edges wherever exposed to view.

2.02 GLAZING SEALANTS, COMPOUNDS AND GASKETS:

A. Colors: Provide black or other natural color where no other color is available. Where material is not exposed to view, provide manufacturer's standard color which has the best overall performance characteristics for application shown.

B. Hardnesses shown and specified are intended to indicate general range necessary for overall performance. Consult manufacturer's technical representative to determine actual hardness recommended for conditions of installation and use. Architect will furnish information concerning anticipated glass movement related to actual glazing channel width and installation temperature upon request. Except as otherwise indicated or recommended, provide glazing materials within the following ranges of hardness (Shore A, fully cured, at 75 degrees F.):

1. 15 to 35 for elastomeric compounds and tapes used with rigid stops and frames for large glass sizes (in excess of 100 united inches). Provide material sufficiently hard to withstand exposure (if any) to abrasion and vandalism.

2. 25 to 50 for rubber-like curing compounds used with rigid stops and frames for medium and small glass sizes (less than 100 united inches). Provide materials sufficiently hard to withstand impact where used on moving sash and doors.

3. 35 to 60 for molded gaskets used with rigid stops and frames, depending upon strength needed for applications or insertion of units and open profile of gasket.

4. 70 to 80 for structural gaskets (not supported by stops).

5. Non-Elastomeric Compounds: (Shore A not applicable) 2 to 12 mm penetration for 5.0 seconds of penetrometer needle on nominally cured compound (ASTM D 2451).

C. Compatibility: Before purchase of specified glazing materials, investigate compatibility with channel surfaces, joint fillers, and other materials in glazing channel. Provide only materials (manufacturer's
recommended variation of specified materials) which are known to be fully compatible with actual installation condition, as shown by manufacturer's published data or certification.

D. Provide size and shape of gaskets and preformed glazing units as shown, or if not shown, as recommended by manufacturer, either in published data or upon consultation with technical representative.

E. Two-Component Polysulfide Glazing Sealant:

1. Polysulfide-based, 2--art elastomeric sealant, comply with FS TT-S-00227, Class A, Type 2 (non-sag); certified by manufacturer to be specifically compounded for glazing application, with sufficient resistance to UV deterioration to show no significant change for 20 years of normal glazing exposure to the sun.

2. Product/Manufacturer:
   a. Lasto-Meric; Tremco, Inc.

3. Use for cap bead on all sloped glazing.

F. Nonporous Bond Silicone Rubber Glazing Sealant"

1. One-part acid-type silicone rubber elastomeric sealant, complying with FS TT-S-001543, Class A, non-sag, recommended by manufacturer for non-porous exterior joint surfaces and for glazing.

2. Products/Manufacturers: Provide one of the following:
   a. 781 Building Sealant; Dow Corning Corporation
   b. Silicone Construction 1200 Sealant; General Electric Company
   c. Rhodorsil Sealant 3B; Rhodia Inc. Chemical Division

G. Preformed Butyl Rubber Glazing Sealant:

1. Preformed ribbon or tape (coiled with release paper) of polymerized butyl (or mixture of butyl and polyisobutylene) with inert fillers (pigments), solvent-based with minimum 95% solids, non-sag consistency, tack-free time of 24 hours or less, paintable, non-staining, pre-shimming to prevent stretch (as required
by Glazier to facilitate proper application and glass installation).

2. Product/Manufacturer:
   a. Polyshim Tape: Tremco, Inc.

3. Use for exterior glazing of all glass in aluminum window wall metal framed skylight and in all interior glazing.

H. Gaskets:

1. Refer to Section 07812 for gaskets part of metal framed skylight.

2.03 MISCELLANEOUS GLAZING MATERIALS:

A. Channel Cleaner: Use type compound recommended by sealant manufacturer for channel surfaces to be cleaned.

B. Channel Primer/Sealer: Provide type of primer or sealer recommended by sealant manufacturer for application of sealant to channel surfaces.

C. Setting Blocks: Neoprene or other resilient blocks of 70 to 90 Shore A durometer hardness, tested for compatibility with specified glazing sealants.

D. Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesively backed on one face only, tested for compatibility with specified glazing sealants.

E. Compressible Filler Rod: Closed-cell or waterproof-jacketed foam of polyethylene, butyl rubber, neoprene, polyurethane, or vinyl tested for compatibility with specified glazing sealants of 5 to 10 psi compression strength (25% deflection) as recommended by sealant manufacturers for use in glazing channel to prevent sealant exudation from channel.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Glazier must examine framing and substrate work to receive glass and glazing materials and conditions under which glass is to be installed, and notify Contractor, in writing, of conditions detrimental to proper completion of the work. Do not proceed with glazing until unsatisfactory conditions have been corrected in a manner
acceptable to Glazier.

3.02 PERFORMANCE REQUIREMENTS:

A. Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes wind loading, and impact loading (for operating sash and doors) without failure, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.

B. Protect glass from edge damage during handling, installation and operation of building systems/equipment. Glass breakage during warranty period is a form of faulty material or workmanship (resulting from edge damage) unless known to result from vandalism or other causes not related to materials and workmanship.

C. Glazing channel dimensions as shown are intended to provide for necessary minimum bite on glass, minimum edge clearance, and adequate sealant thickness with reasonable tolerances. Glazier is responsible for correct glass size for each opening within tolerances and necessary dimensions established.

3.03 INSTALLATION

A. General and Standards:

1. Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturers' technical representatives direct otherwise.

2. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, drawn, and bow oriented in the same direction as other pieces.

3. Inspect each piece of glass immediately before installation and eliminate pieces which have observable edge damage or face imperfections.
4. Do not attempt to cut, seam, nip or abrade glass which is tempered, heat strengthened, or coated.

5. Cut and install colored (tinted) and heat absorbing glass as recommended in "Technical Services Report No. 104" (latest edition) by PPG Industries, or similar report by other glass manufacturer.

6. Comply with applicable publications by Flat Glass Marketing Association, except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.

B. Preparation of Substrate:

1. Clean the glazing channel or other framing member to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to the substrate. Remove lacquer from metal surfaces where elastomeric sealants are used.

2. Apply primer or sealer to joint surfaces where recommended by sealant manufacturer.

C. Sealant/Compound Glazing:

1. Install setting blocks of proper size in sill rabbet, locate at one-fourth of glass width measured from each jamb. Set blocks in thin course of the heel bead compound if heel bead is to be installed.

2. Provide spacers inside and out, and of proper size and spacing for glass sizes larger than 50 united inches, except where pre-shimmed tape or gaskets are used for glazing. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant width, except with butyl rubber sealant tape use thickness 1/32" less than final compressed thickness of tape.

3. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in channels at heel of jambs and heads (do not leave voids in sill channels), except as otherwise indicated. In general, voids or filler rods are required for insulating glass and for laminated glass larger than 75 united inches, and for other glass more than 9/32" thick or larger than 120 united inches.
4. Force sealants into channel to eliminate air pockets and voids (other than expansion voids), and to ensure complete "wetting" and bond of sealant to glass and channel surfaces.

5. Tool exposed surfaces of glazing sealants and compounds to provide a substantial "wash" away from glass.

6. When installing processed glass, exercise extraordinary care to avoid contact of glazing materials with processed surfaces, except where concealed in glazing channel. Use masking tape to ensure limitation of compounds to channel area.

7. Clean and trim excess glazing materials from glass and stops or frames promptly after installation, and eliminate stains and discolorations.

D. Gaskets and Tapes:

1. Miter cut and bond ends together at corners where gaskets are used for channel glazing so that gaskets will not pull away from corners and result in voids or leaks in glazing system.

2. Install pressurized tapes and gaskets to protrude slightly out of channel so as to eliminate dirt and moisture pockets. Trim to straight line as required.

3.04 CURE AND PROTECTION:

A. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength, and surface durability.

B. Glazier shall advise the Construction Manager of procedures required for protection of glass and glazing sealants and compounds during construction period so that they will be without deterioration or damage (other than normal weathering) at time of Owner's acceptance.

1. Furnish specific instruction to the Construction Manager on precautions and provisions required to
prevent glass damage resulting from the alkaline wash from green concrete surfaces and similar sources of possible damage.

2. Protect exterior glass from breakage immediately upon installation by attachment of crossed streamers to framing held away from glass. Do not apply markers directly on surfaces of glass. Except as otherwise indicated, remove applied labels from glass surfaces immediately after glass installation.

3. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during the construction period, including pieces damaged through natural causes, accidents and vandalism.

3.05 CLEANING GLASS:

A. Maintain glass in a reasonably clean condition during construction so that it will not be damaged by corrosive or erosive action and will not contribute (by wash-off) to deterioration of glazing materials and other work.

1. Clean glass in accordance with manufacturer's recommendations. Do not use abrasive materials. On glass, do not use broken razor blades for cleaning.

B. Wash and polish glass on both faces not more than 4 days prior to Owner's acceptance of the work in each area. Comply with glass manufacturer's recommendations.

END OF SECTION 08800
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

SECTION 08810 - FIRE-RATED GLASS - FIRELITE PLUS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire-rated glazing (FireLite Plus) materials installed as vision lights in fire-rated doors.

B. Related Sections include the following:
   1. Section 08112 - Hollow Metal Work
   2. Section 08210 - Wood Doors

1.2 REFERENCES

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

B. American National Standards Institute (ANSI):

C. Consumer Product Safety Commission (CPSC):

D. Glass Association of North America (GANA):
   2. FGMA - Sealant Manual.

E. National Fire Protection Association (NFPA):

F. Underwriters Laboratories, Inc. (UL):
   1. UL 10N: Fire tests of Door Assemblies.
   2. UL10C: Positive Pressure Fire Tests of Door Assemblies.


1.3 PERFORMANCE REQUIREMENTS

A. FireLite Plus
   1. Fire-rated glass ceramic laminated, clear and wireless
      glazing material for use in impact safety rated
      locations such as doors with fire rating requirements
      ranging from 20 minutes to 3 hours with required hose
      stream test.

1.4 SUBMITTALS

A. Comply with requirements of Section 01330.

B. Product data: Submit manufacturer’s technical data for each
   glazing material required, including installation and
   maintenance instructions.

B. Certificates of compliance from glass and glazing materials
   manufacturers attesting that glass and glazing materials
   furnished for project comply with requirements. Separate
   certification will not be required for glazing materials
   bearing manufacturer’s permanent label designating type and
   thickness of glass, provided labels represent a quality
   control program involving a recognized certification agency
   or independent testing laboratory acceptable to authority
   having jurisdiction.

C. Product Test Listings: From UL indicating fire-rated glass
   complies with requirements, based on comprehensive testing
   of current product.

D. Samples: Submit, for verification purposes, approx. 8-inch
   by 10-inch sample for each type of glass indicated.

1.5 QUALITY ASSURANCE


B. Fire Resistance Rated Glass: Each lite shall bear
   permanent, nonremovable label of UL certifying it for use
   in tested and rated fire resistive assemblies.
C. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E-2074-00 and UL10B, labeled and listed by UL.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials under provisions of Section 01140.

B. Deliver materials to specified destination in manufacturer or distributor's packaging, undamaged, complete with installation instructions.

C. Store off ground, under cover, protected from weather and construction activities.

D. Do not expose Pilkington Pyrostop™ to temperatures greater than 120 degrees or less than minimum 40 degrees F during storage and transportation.

   1. Do not expose the non-PVB side of glass to UV light.
   2. Store sheets of glass vertically. DO NOT lean.

1.7 WARRANTY

A. Provide manufacturer's limited warranty under provision of Division One.

B. Warranty period: Five years from date of substantial completion.

PART 2 - PRODUCTS

2.1 FIRE-RATED GLAZING MATERIALS

A. FireLite Plus: as manufactured by the Nippon Electric Glass Company, LTD and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065, voice 1-800-426-0279, fax 1-800-451-9857, e-mail sales@fireglass.com, Web site www.fireglass.com.

   1. Properties:
      a. Thickness: 5/16”.
      b. Weight: 4 lbs. /s.f.
      c. Approximate Visible Transmission: 85% +/-.
d. Fire-rating: Provide ratings of 20-minute as indicated on drawings.
f. STC Rating: 35 dB +/-.

2. Maximum sheet sizes based on surface finish:

3. Permanently label each piece of FireLite Plus FireLite Logo, UL Logo and Fire rating in sizes up to 3,325 square inches and with the FireLite label only for sizes that exceed the listing (as approved by the local authority having jurisdiction).

4. Fire Rating – Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E2074-00, NFPA 252, UL 10B and UL10C.

5. Substitutions: Equal products by the following manufacturers will be considered:

2.2 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, FireLite Plus glass panels that exceed 1,393 square inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by the manufacturer.

B. Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:
   1. Dow Corning 795 - Dow Corning Corp.
   2. Silglaze-II 2800 - General Electric Co.
   3. Spectrem 2 - Tremco Inc.
C. Setting Blocks:
   1. FireLite Plus:
      a. Neoprene, EPDM or Silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.

   2. Pyrostop:
      a. Hardwood or calcium silicate; glass width by 4 inches by 3/16 inches thick.

D. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

2.3 FABRICATION

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:

   1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.

   2. Minimum required face or edge clearances.

   3. Observable edge damage or face imperfections.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

C. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.
A. FireLite Plus

1. Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.

2. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.

3. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

4. Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.

5. Place setting blocks located at quarter points of glass with edge block no more than 6-inches from corners.

6. Glaze vertically into labeled fire-rated metal frames or partition walls with the same fire rating as glass and push against tape for full contact at perimeter of pane or unit.

7. Place glazing tape on free perimeter of glazing in same manner described above.

8. Install removable stop and secure without displacement of tape.

9. Install in vision panels in fire-rated doors to requirements of NFPA 80.

10. Install so that appropriate UL and FireLite Plus markings remain permanently visible.

3.3 PROTECTION AND CLEANING

A. Protect glass from contact with contaminating substances resulting from construction operations. Remove any such substances by method approved by glass manufacturer.
B. Wash glass on both faces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

END OF SECTION 08810
PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

   A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY:

   A. Extent of each type of gypsum drywall construction required is indicated on Drawings.

   B. This Section includes the following types of gypsum board construction:

      1. Steel framing members to receive gypsum board.
      2. Gypsum board screw-attached to steel framing and furring members.

1.3 DEFINITIONS:

   A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA 505 for definitions of terms for gypsum board construction not otherwise defined in this section or other referenced standards.

1.4 SUBMITTALS:

   A. Product data from manufacturers for each type of product specified.

1.5 QUALITY ASSURANCE:

   A. Fire-Resistance Ratings: Where indicated, provide materials and construction which are identical to those of assemblies whose fire resistance rating has been determined per ASTM E 119 by a testing and inspecting organization acceptable to authorities having jurisdiction.

      1. Provide fire-resistance-rated assemblies identical to those indicated by reference to GA File No's. in GA-600 "Fire Resistance Design Manual" or to design designations in U.L. "Fire Resistance Directory" or in listing of other testing and agencies acceptable to authorities having jurisdiction.
B. Single Source Responsibility: Obtain each type of gypsum board and related joint treatment materials from a single manufacturer.

C. All gypsum board drywall and associated materials shall be manufactured domestically in the United States, by a United States Company and shall conform to ASTM Standards listed herein. Gypsum board drywall and associated materials shall not be imported, rebranded or distributed from another country.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.

C. Handle gypsum boards to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.7 PROJECT CONDITIONS:

A. Environmental Conditions, General: Establish and maintain environmental conditions for application and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.

B. Minimum Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously thereafter until drying is complete.

C. Ventilatate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during dry, hot weather to prevent materials form drying too rapidly.
PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Steel Framing and Furring:
   a. Clark Steel Framing.
   b. Dietrich Industries, Inc.
   c. Marino/Ware, Division of Ware Industries
   d. Dale/Incor (Dale Industries)

2. Gypsum Boards and Related Products:
   a. Georgia-Pacific Corp.
   c. United States Gypsum Co.

2.2 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS:

A. General: Provide components which comply with ASTM C 754 for materials and sizes, unless otherwise indicated.

B. Concrete Inserts: Inserts designed for attachment to concrete forms and for embedment in concrete, fabricated from corrosion-resistant materials, with holes or loops for attachment of hanger wires and capability to sustain, without failure, a load equal to 3 times that imposed by ceiling construction, as determined from testing per ASTM E 488, conducted by an independent testing laboratory.

C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.

D. Channels: Cold-rolled steel, 0.0598 inch minimum thickness of base (uncoated) metal and 7/16 inch wide flanges, protected with rust-inhibitive paint, and as follows:

   1. Carrying Channels: 1-1/2 inch deep, 475 lbs per 1000 ft., unless otherwise indicated.
   2. Furring Channels: 3/4 inch deep, 300 lbs per 1000 ft., unless otherwise indicated.
E. Steel Studs for Furring Channels: ASTM C 645, with flange edges bent back 90 deg and doubled over to form 3/16 inch minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:

1. Thickness: 0.0329 inch, unless otherwise indicated.
2. Depth: 3-5/8 inches, unless otherwise indicated.

F. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth of 7/8 inches, and minimum thickness of base (uncoated) metal as follows:

1. Thickness: 0.0329 inch, unless otherwise indicated.

G. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, complying with ASTM C 645 for material, finish and widths of face and fastening flange, fabricated to form 1/2 inch deep channel of the following configuration:

1. Single-Leg Configuration: Asymmetric-shaped channel with face connected to a single flange by a single slotted leg (web).

H. Grid Suspension System: ASTM C 645, manufacturer's standard grid suspension system composed of main beams and cross furring members which interlock to form a modular supporting network.

2.3 STEEL FRAMING FOR WALLS AND PARTITIONS:

A. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 deg and doubled over to form 3/16" minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:

1. Thickness: 0.0329 inch where indicated.
2. Depth: 3-5/8 inches, unless otherwise indicated.

B. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:

1. Depth: 7/8 inch.
2. Thickness: 0.0329 inch, unless otherwise indicated.
C. Furring Brackets: Serrated-arm type, adjustable, fabricated from corrosion-resistant steel sheet complying with ASTM C 645, minimum thickness of base (uncoated) metal of 0.0329 inch, designed for screw attachment to steel studs and steel rigid furring channels used for furring.

D. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, complying with ASTM C 645 for base metal, finish and widths of face and fastening flange, fabricated to form 1/2 inch deep channel of the following configuration:

1. Single-Leg Configuration: Asymmetric-shaped channel with face connected to a single flange by a single slotted leg (web).

E. Fasteners: Provide fasteners of type, material, size, corrosion resistance, holding power and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum drywall manufacturers for applications indicated.

2.4 GYPSUM BOARD:

A. General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end joints.

1. Thickness: Provide gypsum board in thicknesses indicated, or if not otherwise indicated, in either 1/2 inch or 5/8 inch thicknesses to comply with ASTM C 840 for application system and support spacing indicated.

B. Gypsum Wallboard: ASTM C1396, and as follows:

1. Type: Regular, unless otherwise indicated.
2. Type: Foil-backed where indicated.
3. Type: Type X for fire-resistance-rated assemblies.
5. Thickness: 1/2 inch, unless otherwise indicated.
6. Thickness: 5/8 inch where indicated.
7. Products: Subject to compliance with requirements, provide one of the following products where Type X gypsum wallboard is indicated:
   
a. "Gyprock Fireguard 'C' Gypsum Board"; Domtar Gypsum Co.
   c. "SHEETROCK Brand FIRECODE 'C' Gypsum Panels"; United States Gypsum Co.

C. Gypsum Backing Board for Multi-Layer Applications: ASTM C1396 or, where backing board is not available from manufacturer, gypsum wallboard, ASTM C1396, and as follows:
   
1. Type: Regular, unless otherwise indicated.
2. Type: Foil-backed where indicated.
3. Type: Type X for fire-resistance-rated assemblies.
4. Edges: Manufacturer's standard.
5. Thickness: 5/8 inch, unless otherwise indicated.
6. Thickness: 1/2 inch where indicated.

D. Water-Resistant Gypsum Backing Board: ASTM C1396, and as follows:
   
1. Type: Regular, unless otherwise indicated.
2. Type: Type X for fire-resistance-rated assemblies.
3. Thickness: 5/8 inch, unless otherwise indicated.

E. Vandal Resistant Gypsum Board: ASTM C1629 (Noted as hi-impact gypsum board on wall types) Provide assembly consisting of 5/8'' Hi-Impact brand XP gypsum wallboard as manufactured by National Gypsum with tapered edges with reinforced taped joints (profoam joint tape) and concealed with profoam ready mix or setting compounds and epoxy paint on finished surface, or equal as determined by Architect.

2.5TRIM ACCESSORIES:
A. Cornerbead and Edge Trim for Interior Installation:
   Provide corner beads, edge trim and control joints which comply with ASTM C 1047 and requirements indicated below:

1. Material: Formed metal, plastic or metal combined with paper, with metal complying with the following requirement:
   a. Sheet steel zinc-coated by hot-dip process.

2. Edge trim shapes indicated below by reference to designations of Fig. 1 in ASTM C 1047:
   a. "LC" Bead, unless otherwise indicated.
   b. "L" Bead where indicated.
   c. "U" Bead where indicated.

3. One-Piece Control Joint: Formed with vee-shaped slot per Fig. 1 in ASTM C 1047, with slot opening covered with removable strip.

B. Metal Cornerbead and Edge Trim for Exterior Ceilings:
   Comply with the following requirements:

1. Edge trim complying with ASTM C 1047, formed from rolled zinc, shape "LC" Bead per Fig. 1, unless otherwise indicated.

2.6 GYPSUM BOARD JOINT TREATMENT MATERIALS:

A. General: Provide materials complying with ASTM C 475, ASTM C 840, and recommendations of manufacturer of both gypsum board and joint treatment materials for the application indicated.

B. Joint Tape: Paper reinforcing tape, unless otherwise indicated.

1. Use pressure sensitive or staple-attached open-weave glass fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.

C. Setting-Type Joint Compounds: Factory-prepackaged, job-mixed, chemical-hardening powder products formulated for uses indicated.

1. Where setting-type joint compounds are indicated for use as taping and topping compounds, use formulation
for each which develops greatest bond strength and crack resistance and is compatible with other joint compounds applied over it.

2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.

3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer for this purpose.

D. Drying-Type Joint Compounds: Factory-prepackaged vinyl-based products complying with the following requirements for formulation and intended use.


2. All-purpose compound formulated for use as both taping and topping compound.

2.7 MISCELLANEOUS MATERIALS:

A. General: Provide auxiliary materials for gypsum drywall construction which comply with referenced standards and the recommendations of the manufacturer of the gypsum board.

B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum boards.

C. Spot Grout: ASTM C 475, setting-type joint compound of type recommended for spot grouting hollow metal door frames.


E. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum boards to steel framing.

F. Gypsum Board Screws: ASTM C 1002.

G. Gypsum Board Nails: ASTM C 514.

H. Concealed Acoustical Sealant: Nondrying, nonhardening, nonskinning, nonstaining, nonbleeding, gunnable sealant complying with requirement specified in Division-7 section "Joint Sealers."
I. Sound Attenuation Blankets: Unfaced mineral fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing); and as follows:

1. Mineral Fiber Type: Fibers manufactured from glass.
2. Use in all partitions, full height to deck above.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine substrates to which drywall construction attaches or abuts, preset hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of drywall construction. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

A. Ceiling Anchorages: Coordinate installation of ceiling suspension system with installation of overhead structural systems to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling anchors in a manner that will develop their full strength and at spacing required to support ceiling.

3.3 INSTALLATION OF STEEL FRAMING, GENERAL:

A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer, or if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.

C. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at locations indicated below to comply with details shown on Drawings:
1. Where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetration of structural elements.

2. Where partition and wall framing abuts overhead structure.
   a. Provide slip or cushioned type joints as detailed to attain lateral support and avoid axial loading.

D. Do not bridge building expansion and control joints with steel framing or furring members; independently frame both sides of joints with framing or furring members or as indicated.

3.4 INSTALLATION OF STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS:

A. Secure hangers to structural support by connecting directly to structure where possible, otherwise connect to cast-in concrete inserts or other anchorage devices or fasteners as indicated.

1. Do not attach hangers to metal deck tabs (where present).
2. Do not attach hangers to metal roof deck (where present).

B. Do not connect or suspend steel framing from ducts, pipes or conduit.

C. Keep hangers and braces 2 inches clear of ducts, pipes and conduits.

D. Sway-brace suspended steel framing with hangers used for support.

E. Install suspended steel framing components in sizes and at spacings indicated but not less than that required by referenced steel framing installation standard.

1. Wire Hangers: 0.1620 inch diameter (8 gage), 4 ft. on center.
2. Carrying Channels (Main Runners): 1-1/2 inch, 4 ft. on center.
3. Rigid Furring Channels (Furring Members): 16 inches on center.
4. Rigid Furring Channels (Furring Members): 24 inches on center.

F. Installation Tolerances: Install steel framing components for suspended ceilings so that cross furring members or grid suspension members are level to within 1/8 inch in 12 ft. as measured both lengthwise on each member and transversely between parallel members.

G. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

H. For exterior soffits provide cross-bracing and additional framing indicated or required to resist wind uplift.

3.5 INSTALLATION OF STEEL FRAMING FOR WALLS AND PARTITIONS:

A. Install runners (tracks) at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other construction.

1. Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surface do not vary more than 1/8 inch from plane of faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

D. Terminate partition framing at suspended ceilings where indicated.

E. Install steel studs and furring in sizes and at spacings indicated but not less than that required by referenced steel framing installation standard.

1. For single layer construction: 16 inches on center.

F. Install steel studs so that flanges point in the same direction and gypsum boards can be installed in the direction opposite to that of the flange.
G. Frame door openings to comply with details indicated, with GA-219 and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

H. Frame openings other than door openings to comply with details indicated, or if none indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

3.6 APPLICATION AND FINISHING OF GYPSUM BOARD, GENERAL:

A. Gypsum Board Application and Finishing Standard: Install and finish gypsum board to comply with ASTM C 840.

B. Install sound attenuation blankets in all partitions/shaft walls whether indicated or not and other locations where indicated, prior to gypsum board unless readily installed after board has been installed.

C. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.

D. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24 inches.

E. Install wall/partition boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.

F. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.

G. Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or
gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.

H. Attach gypsum board to steel studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flange first.

I. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.

J. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32 inches wide. Apply spot grout at each jamb anchor clip just before inserting board into frame.

K. Form control joints and expansion joints at locations indicated, with space between edges of boards, prepared to receive trim accessories.

L. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls which are braced internally.

1. Except where 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. area, and may be limited to not less than 75 percent of full coverage.

2. Fit gypsum board around ducts, pipes, and conduits.

M. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4 inch to 1/2 inch space and trim edge with "U" bead edge trim. Seal joints with acoustical sealant.

N. At all drywall partitions, seal construction at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim, and close off sound-flanking paths around or through construction, including sealing of partitions above acoustical ceilings.

O. Space fasteners in gypsum boards in accordance with
referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.7 METHODS OF GYPSUM BOARD APPLICATION:

A. Single-Layer Application: Install gypsum wallboard as follows:

1. On ceilings apply gypsum board prior to wall/partition board application to the greatest extent possible.

2. On partitions/walls apply gypsum board vertically (parallel to framing), unless otherwise indicated, and provide sheet lengths which will minimize end joints.

3. On partitions/walls 8'-1" or less in height apply gypsum board horizontally (perpendicular to framing); use maximum length sheets possible to minimize end joints.

B. Wall Tile Base: Where drywall is base for thin-set ceramic tile and similar rigid applied wall finishes, install gypsum backing board.

1. In "dry" areas install gypsum backing board or wallboard with tapered edges taped and finished to produce a flat surface.

2. At showers, tubs and similar "wet" areas, install water-resistant gypsum backing board to comply with ASTM C 840 and recommendations of gypsum board manufacturer.

C. Double-Layer Application: Install gypsum backing board for base layer and gypsum wallboard for face layer.

1. On ceilings apply base layer prior to application of base layer on walls/partitions; apply face layers in same sequence. Offset joints between layers at least 10 inches. Apply base layers at right angles to supports unless otherwise indicated.

2. On partitions/walls apply base layer and face layers vertically (parallel to framing) with joints of base layer over supports and face layer joints offset at least 10 inches with base layer joints.

D. Acoustical Tile Base: Where drywall is base for adhesively applied acoustical tile, install gypsum backing board.
1. Provide either V-joint type backing board or tape and finish joints to produce a flat surface.

E. Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:

1. Fasten with screws.

F. Double-Layer Fastening Methods: Apply base layer of gypsum board and face layer to base layer as follows:

1. Fasten both base layers and face layers separately to supports with screws.

G. Direct-Bonding to Substrate: Where gypsum board is indicated to be directly adhered to a substrate (other than studs, joists, furring members or base layer of gypsum board), comply with gypsum board manufacturer's recommendations, and temporarily brace or fasten gypsum board until fastening adhesive has set.

H. Exterior Soffits and Ceilings: Apply exterior gypsum soffit board perpendicular to supports, with end joints staggered over supports. Install with 1/4 inch open space where boards abut other construction.

1. Fasten with cadmium-plated screws, or with galvanized or aluminum nails where supports are nailable.

3.8 INSTALLATION OF DRYWALL TRIM ACCESSORIES:

A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.

B. Install corner beads at external corners.

C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where "U" bead (semi-finishing type) is indicated.

1. Install "LC" bead where drywall construction is tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
2. Install "L" bead where edge trim can only be installed after gypsum board is installed.

3. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).

D. Install plastic edge trim where indicated on wall panels at juncture with ceilings.

E. Install control joints at locations indicated, or if not indicated, at spacings and locations required by referenced gypsum board application and finish standard, and approved by the Architect for visual effect.

3.9 FINISHING OF DRYWALL:

A. General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects and elsewhere as required to prepare work for decoration.

B. Prefill open joints and rounded or beveled edges, if any, using setting-type joint compound.

C. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

D. Finish interior gypsum wallboard by applying the following joint compounds in 3 coats (not including prefill of openings in base), and sand between coats and after last coat:

   1. Embedding and First Coat: Setting-Type Joint Compound.

   2. Fill (Second) Coat: Setting-type joint compound.

   3. Finish (Third) Coat: Ready-mix drying-type all-purpose or topping compound.

E. Finish exterior gypsum soffit board by using setting-type joint compounds to prefill joints, embed tape, and to apply first, fill (second) and finish (third) coats; smooth each coat before joint compound hardens to minimize need for sanding; sand between coats and after finish coat.
1. Painting of exterior gypsum soffit board after finish coat has dried is specified in Division-9 Section "Painting."

F. Water-Resistant Backing Board Base for Ceramic Tile: Finish joints between water-resistant backing board with tape and setting-type joint compound to comply with gypsum board manufacturer's recommendations and installation standards referenced in Division-9 Section "Tile"

G. Base for Acoustical Tile: Where gypsum board is indicated as a base for adhesively-applied acoustical tile, install tape and 2-coat compound treatment, without sanding.

H. Partial Finishing: Omit third coat and sanding on concealed drywall construction which is indicated for drywall finishing or which requires finishing to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.

3.10 PROTECTION:

A. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall construction being without damage or deterioration at time of Substantial Completion.

END OF SECTION 09250
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

A. The extent of tile work is shown on drawings and in schedules.

1.03 QUALITY ASSURANCE:

A. Qualifications of Installers:

1. For installation of ceramic tile, use only thoroughly trained and experienced personnel completely familiar with specified products, manufacturer's recommended methods of installation and requirements established for this work.

B. Codes and Standards:

2. Comply with ANSI and ASTM Standards listed within this Section.

C. Proprietary Materials: Handle, store, mix and apply proprietary setting and grouting materials in compliance with manufacturer's instructions.

1.04 SUBMITTALS:

A. Product Data:

1. For information only, submit two (2) copies of manufacturer's technical information and install instructions for all materials required, except bulk materials. Include certifications and other data as may be required to show compliance with these specifications. Transmit a copy of each instruction to the Installer.
2. Accompany materials list with two (2) copies of manufacturer's current recommended method of installation for each item. These recommendations, after review by Contractor and Architect/Engineer, shall form basis for acceptance or rejection of installed work.

B. Samples:

1. Submit three (3) samples of each type and color of tile required, not less than 12" square on plywood or hardboard backing and grouted. Submit samples of trim and 6" long sample of marble threshold. Review will be for color, pattern and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

1.05 DELIVERY AND STORAGE:

A. Deliver packaged materials and store in original containers with seals unbroken and labels in tact until time of use, in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Tile: Subject to compliance with requirements, provide products as follows:

1. Wall Tile: (PCT)
   Virginia Tile
   Crossville, Argent, Porcelain Stone
   Finish: polished
   Tile Thickness: 9.5mm
   Field Tile Size: 12''x24''
   Accent Band Tile Size: 6''x24'' (see elevations)
   Recommended Grout Joint: Between 3/16'' and 1/4''
   Color: Architect shall select multiple colors from manufacturer’s full line.
   Manufacturer’s Representative: Robin Speer
   734-765-6875.

2. Wall Cove Base: (PCT)
   Virginia Tile
   Crossville, Argent, Porcelain Stone
   Finish: polished
   Tile Thickness: 9.5mm
Base Size: 6’’x24’’
Recommended Grout Joint: Between 3/16’’ and 1/4’’
Color: Architect shall select multiple colors from manufacturer’s full line.
Manufacturer’s Representative: Robin Speer 734-765-6875.

1. Furnish tile complying with “Standard Grade” requirements unless otherwise indicated.

C. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.

2.02 SETTING MATERIALS

A. MEDIUM SET MORTAR – for wall and floor tile installation in lobby and toilet rooms:

1. Description: Factory prepared mortar and latex additive; complying with ANSI A118.4 and ISO standards C2TES1P1. Medium bed thickness; 3/8 to 3/4 inch thick floor installation.
2. Color: Gray
3. Acceptable Products:
   i. MAPEI UltraFlex LFT, complies with ANSI A118.4
   ii. Custom Building Products, MegaLite.
   iii. Laticrete, 4XLT.

B. Latex-Portland Cement Mortar: ANSI A118.4, composed as follows:

1. Mixture of Dry-Mortar Mix and Latex Additive: Mixture the prepackaged dry-mortar mix and liquid-latex additive complying with the following requirements:
2. Provide one of the following products:
   a. Mapei, Elk Grove Village, IL; Kerabond/Keralastic
   b. Custom Building Products, Custom Blend/Custom Flex
   c. Laticrete, Bethany, CT; Laticrete 272/333
   d. TEC, Palatine, IL; Full set plus/Xtra Flex Additive
C. Waterproofing and Crack Isolation Membrane: Provide materials complying with ANSI A118.10 and ANSI A118.12 and as specified below. Note: All wall tile to be installed on crack isolation membrane:

1. Mapelastic AquaDefense as manufactured by MAPEI Corp.
3. Hydroment ultra-set advanced as manufactured by Bostik, Inc.
5. Hydraflex as manufactured by TEC. Ready to use, flexible, mold and mildew resistant waterproofing and crack isolation membrane for interior and exterior applications.

2.03 GROUTING MATERIALS
A. Pre-mixed grout complying with ANSI A118.3 for stain resistance.

1. Provide one of the following manufacturers:
   a. Mapei, FlexColor CQ Grout.
   b. TEC, InColor Advanced Performance Grout.
   c. Bostik, TruColor Pre-mixed Urethane Grout
   d. Laticrete, Plasma Pre-mixed Urethane Grout.

B. Color: As selected by Architect.

2.04 MISCELLANEOUS MATERIAL
A. Latex Underlayment: Quick set type, as recommended by membrane manufacturer, as required to provide positive drainage to floor drains.

B. Sealer for Quarry Tile: Shall be a penetrating sealer as manufactured by Aqua Mix Inc., Santa Fe Springs, California, Miracle Sealants Penetrating Sealer, Arcadia, California, or Architect approved equivalent. (Seal prior to grouting)

C. Sealants for control joints in floors and walls, use one part fungicidal silicone rubber to match grout, Dow Corning 784, meeting Fed. Spec. TT-S-001543, Class A or B.

D. Rounded Metal trim on outside vertical wall corners and at
all vertical and horizontal exposed tile edges around door and window frames, etc.: Schluter Rondec, Satin anodized aluminum, 5/16'' (RO 80AE) with factory made corners.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Installer must examine the areas and conditions under which tile work is to be installed and notify the Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 PREPARATION:

A. Prepare substrate to receive setting bed and tile recommended both by the manufacturer of the tile and of the setting bed materials.
   1. Fill cracks, holes and depressions with trowelable leveling and patching compound according to tile setting material manufacturer’s written instructions.
   2. Remove protrusions, bumps and ridges by sanding or grinding.
   4. Apply skim coat full height to all walls to receive wall tile.
   5. Apply self leveling agent to entire floor to receive floor tile.

B. Clean substrate as required and recommended to achieve bond using cleaners, detergents, etc.

C. Neutralize and seal substrates as recommended.

3.03 INSTALLATION:

A. Tile Installation - General:
   1. Provide installation of ceramic tile in accordance with Tile Council of America's "Handbook for Ceramic Tile Installation."

   2. Fit tile carefully against trim and around pipes, electrical boxes and other built-up fixtures so that escutcheons, plates and collars will completely
overlap cut edges.

3. Smooth exposed edges and clean tile before installation.

4. Install ceramic tile with a nominal 1/8" joint (unless noted otherwise).

5. Joint designs shall be symmetrical within room or area; border tile be not less than 1/2 normal width. Floor tile shall be set in straight line design, with wall joints in alignment with floor tile where possible.

6. At junction of base tile and wall tile, at projections through tile and at junctions of tile to shower receptors, urinals, corner guards and similar equipment, leave joint ungrouted for sealing.

7. When using tile sheets, minimize tearing sheets apart.

3.04 SETTING METHODS

A. Method and typical detailing for tile work shall be in accordance with the following TCA alphanumeric method, listing from the "Handbook for Ceramic Tile Installation", latest edition, by the Tile Council of America.

B. Concrete Subfloors


C. Walls

Install crack isolation membrane per manufacturer’s specs.

3.05 GROUTING

A. Grouting shall be installed in accordance with ANSI A108.10 and the manufacturer's recommended procedures and precautions during application and cleaning.

B. Rinse tilework thoroughly with clean water before and after using chemical cleaners.

C. Base Installation:

D. Jointing Pattern: Lay tile in pattern indicated. Layout tile work and enter tile fields both directions in such space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint width, unless otherwise shown.

E. Expansion and Control Joints: Provide as indicated on drawings and as recommended by TCA and by tile and setting bed and grouting material manufacturer and as follows:
   1. Control Joints Locations: Comply with the Tile Council of America. (TCA) and where indicated.
      a. Interior Locations (horizontal and vertical):
         1. Over any expansion joint, control joint, cold joint or seismic joint in the building structure.
         2. Expansion joints - 24 feet to 36 feet in each direction.
         3. Expansion joints - 8 feet to 12 feet where tile work located in direct sunlight or moisture locations.
         4. Where tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, ceiling and where changes
occur in backing materials.
5. Coordinate joint locations with the Architect and for other areas indicated or required.
6. Joint width shall be 3/8 inch, unless otherwise indicated.
7. Provide under-layment systems.
8. Install compatible sealant and color approved by the Architect.

b. Exterior Locations (horizontal and vertical)
1. Expansion joints – 8 feet to 12 feet in each direction.
2. Coordinate joint locations with Architect and for other areas indicated or required.
3. Joint width shall be 3/8 inch to 5/8 inch maximum to suit expansion areas.
4. Provide under-layment systems.
5. Install compatible sealant and of color approved by the Architect.

F. Grout all tile using commercial epoxy grout as specified.

1. Temporarily protect tile as required to prevent staining.

3.04 ADJUST AND CLEAN:

A. Cleaning:

1. Clean grout and setting materials from face of tile while materials are workable. Leave tile face clean and free of all foreign matter.

2. Tile may be cleaned with acid solutions only when permitted by the tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush the surface with clean water before and after cleaning.

B. Finished Tile Work:

1. Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile work.

C. Protection:
1. Apply a protective coat of neutral protective cleaner to completed tile work.

2. Protect installed tile work with Kraft paper or other heavy covering during the construction period to prevent damage and wear.

3. Prohibit all foot and wheel traffic from using tiled floors for at least 3 days, preferably 7 days.

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

END OF SECTION 09300
PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

A. The extent of acoustical panel ceiling is shown on the drawings and in schedules.

1.03 QUALITY ASSURANCE:

A. The installation of acoustical panel ceilings is to be by an experienced installation firm which is acceptable to the manufacturer of the acoustical units, as shown by current written statement from the manufacturer.


C. Fire Hazard Classification: UL tested, listed and labeled as Class 0.25.

1.04 SUBMITTALS:

A. Product Data:

1. For information only, submit 2 copies of manufacturer's product specifications and installation instructions for each acoustical panel ceiling material required, and for suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications. Distribute one additional copy of each installation instruction to the Installer.

a. Include manufacturer's recommendations for cleaning and refinishing acoustical panel, including precautions against materials and methods which may be detrimental to finishes and acoustical performance.
FERNDALE PUBLIC SCHOOLS  
2017 SINKING FUND PROJECTS  
FERNDALE HS-KITCHEN/SERVING LINE  
AND CAFETERIA RENOVATION  
171745  
JANUARY 12, 2018

1.05  SAMPLES

1. Submit 3 sets of 12” square Samples for each acoustical panel required. In each set of samples show the full range of exposed color and texture to be expected in the completed work. Sample submittal and Architect's review will be for color and texture only. Compliance with other requirements is the exclusive responsibility of the Installer.

2. Submit 3, 12” long samples of exposed runner and molding. Architect's review will be for color and texture only. Compliance with other requirements is the exclusive responsibility of the Installer.

C. Maintenance Stock:

1. At the time of completing the installation, deliver stock of maintenance materials to the Owner. Furnish full size units matching the units installed, packaged with protective covering for storage and identified with appropriate labels. Furnish an amount equal to 5.0% of the amount installed.

1.06  JOB CONDITIONS:

A. Space Enclosures: Do not install until interior acoustical panel ceilings unit space has been enclosed and is weather-tight, and until wet work in the space has been completed and is nominally dry and until work above ceilings has been completed, and until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.01  CEILING UNITS:

A. Acoustical Panels: (ACT). (Use at all locations unless noted otherwise)

1. Provide 24” x 24” wet-formed mineral fiber units, not less than ¾” thick with single score. NRC min. 0.60, CAC 35, light reflectance min. 0.82, Reveal edge.
2. Acceptable Products:
   a. Armstrong Item No. 1761, fine-fissured-Second look.
   b. Certainteed: Item No. FFCL-224 Bioshield, fine fissured.
   c. USG: Item No. 2842-Radar-ClimaPlus Illusion.

3. Install in 15/16" exposed tee grid.

2.02 OPEN CELL CEILING SYSTEM (Use in Serving Areas at recessed ceilings only as directed on drawings):

   A. Provide Woodworks Open Cell ‘‘Vector’’ System as manufactured by Armstrong.
      1. Provide four square 24’’ x 24’’ panels, Item #6622, with 12’’ cells.
      2. Suspend system from roof framing in accordance with manufacturer’s instructions.
      3. Suspend system at height indicated on drawings.
      4. Suspension system – 15/16’’ black color.
      5. Color: TBD from standard colors.

2.03 CEILING SUSPENSION MATERIALS:

   A. General: Comply with ASTM C 635, as applicable to an intermediate duty suspension system. Coordinate with other work supported by or penetrating through the ceilings, including light fixtures and HVAC equipment.

   B. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung.
      1. Hanger Wires: Galvanized carbon steel, ASTM A 641, soft temper, prestretched, yield-stress load of at least 3 times design load but not less than 12 USWG.

   C. Exposed Suspension System: Exposed systems compatible with tiles specified and as follows:
      1. Armstrong - 15/16" Prelude XL exposed tee grid.
      2. CertainTeed - 15/16" Classic Aluminum Capped Stab System.
      3. Donn - DX24 System; USG Interiors
D. Edge Moldings: Manufacturer's standard channel molding for grid type used for edges and penetrations of ceiling, with a single flange of molding exposed, finish to match grid.

2.04 MISCELLANEOUS MATERIALS:

A. Acoustical Sealant: A heavy-bodied, non-shrinking, non-drying, non-sag grade mastic compound intended for interior sealing of concealed construction joints.

B. Tile Cement: As recommended by tile manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION WORK:

A. Installer must examine the conditions under which the acoustical ceiling work is to be performed and notify the Construction Manager, in writing, of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid the use of less-than-half widths units at borders, and comply with reflected ceiling plans wherever possible.

3.02 INSTALLATION:

A. General: Install material in accordance with manufacturer's printed instructions and comply with governing regulations as indicated, and industry standards applicable to the work.

B. Install suspension systems to comply with ASTM C 636 with hangers supported only from building structural members as indicated. Locate hangers near each end and spaced 4' - 0' along direct-hung runners, unless otherwise indicated.

1. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for the substrate, and which will not deteriorate or fail with age or elevated temperatures.

C. Install edge moldings at edges of each acoustical ceiling area and at locations where edge of units would otherwise be exposed after completion of the work, except where adhesively applied.
1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed pm back of vertical leg before fastening to vertical surface.

2. Secure moldings to building construction by fastening with screw-anchors into the substrate through holes drilled in not more than 16" o.c. along each molding.

3. Level moldings with ceiling suspension system to level tolerance of 1/8" in 12' - 0".

4. Miter corners of moldings accurately to provide hairline joints, securely connected to prevent dislocation.

D. Cope exposed flanges of intersection suspension system members so that flange faces will be flush (cope flange of member supported by other member) except as otherwise indicated.

E. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at penetrations.

F. Install edge trim moldings where indicated and elsewhere as needed to conceal edges of acoustical units which would otherwise be exposed to view after completion of the work. Anchor with fasteners, or if not possible, secure in place with permanent adhesive.

3.03 CLEANING AND PROTECTION:

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and required to permanently eliminate evidence of damage.

B. The Installer shall advise the Construction Manger of required protection for the acoustical panel ceilings, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION 09510
SECTION 09650 - RESILIENT FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

A. The extent of resilient flooring and accessories is shown on the drawings and in schedule indicated as “LVT” for “Luxury Vinyl Tile Floor”.

1.03 QUALITY ASSURANCE:

A. Wherever possible, provide resilient flooring and accessories produced by a single manufacturer.

B. Fire Test Performance: Provide resilient flooring which complies with the following fire test performance criteria as determined by an independent testing laboratory acceptable to authorities having jurisdiction.

   1. Critical Radiant Flux (CRF): Not less than 0.45 watts per sq. cm. per ASTM E 648.

   2. Flame Spread: Not more than 75 per ASTM E 84.

   3. Smoke Developed: Not more than 450 per ASTM E 84.

   4. Smoke Density: Not more than 450 per ASTM E 662.

1.04 SUBMITTALS:

A. Product Data:

   1. For information only, submit 2 copies of manufacturer's technical data and installation instructions for each type of resilient flooring and accessory. Transmit a copy of each installation instruction to the Installer.
B. Samples:
   1. Submit 3 sets of samples of each type, color and finish of resilient flooring and accessory required. Provide full-size tile units and 6" long sample of accessory. Include full range of flooring color and pattern variation. Sample submittals will be reviewed for color, texture and pattern only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

C. Maintenance:
   1. Submit 2 copies of manufacturer's written instructions for recommended maintenance practices for each type of resilient flooring and accessories.

1.05 JOB CONDITIONS:
   A. Continuously heat areas to receive flooring to 70 degrees F. for at least 48 hours prior to installation, when project conditions are such that heating is required. Maintain 70 degrees F. temperature continuously during and after installation, as recommended by flooring manufacturer, but for not less than 48 hours.

1.06 EXTRA STOCK
   A. Deliver to the Owner, for his use in future modifications, an extra stock of approximately 10% of each color and pattern in each material installed under this Section, packaging each type of material separately, distinctly marked, and adequately protected against deterioration.

PART 2 - PRODUCTS

2.01 TILE FLOORING: (LVT Flooring)
   A. Armstrong "Natural Creations", EarthCuts Parsa: (Basis of Design)
      1. Sizes: 18’’ x 36’’
      2. Thickness: 0.125’’
      3. Finish: UV-cured Polyurethane
      4. Edge Treatment: Square
      5. Static Load: ASTM F970-passes
      7. 20 year limited commercial wear warranty
      8. Recyclability:
      9. Wear Layer: 0.020’’
     10. Contact: Lisa Emrich 517-294-1953
11. ASTM F1700 Class III, Type ‘B’.
12. Multiple color and patterns will be used throughout building. Refer to finish schedules and floor pattern plans.
13. Selections to be made from manufacturers standard color line.

B. Other manufacturers as approved by Architect.

2.02 ACCESSORIES:

A. Resilient Base:

1. Provide vinyl base (Johnsonite vinyl wall base CB) complying with ASTM F-1861, Type TV, Group 1 (solid) in all areas except Admin. Areas and Media Center unless noted otherwise, as follows:
   a. Height: 4" and 6" - refer to drawings for locations.
   b. Thickness: 1/8"
   c. Style: Standard top-set cove or straight type as indicated.
   d. Provide with preformed inside and outside colors.
   e. Provide with quarter round .5" high x .5" wide QTR-XX-A by Johnsonite at all interior door frames and door sidelight frames.
   f. Install per manufacturers specs to maintain warranty.
   g. Color: As selected by Architect. Provide 2 colors per room in pattern TBD.

B. Resilient Stair One Piece Nosing-Tread-Riser and intermediate landing surface. Furnish product consisting of single piece units for width of stair Nosing-Tread-Riser.

1. Provide rubber stair Nosing-Tread-Riser units equal to:
   Norament 925 Grano stair treads by Nora Systems. Provide with phosphorescent permalight safety strip according to DIN 67 510 in the horizontal part of the stair nosing.

2. Provide matching intermediate landings component to tread/riser piece.

3. Install per manufacturers specification to maintain warranty.

4. Color as selected by Architect from manufacturer’s
RESILIENT FLOORING

12 standard colors.
5. Surface texture shall be hammered.

C. Resilient Ramp Surface. Furnish product consisting of single piece units for width of Ramp.
1. Provide rubber ramp units equal to: Norament 925 Grano stair treads by Nora Systems.
2. Install per manufacturers specification to maintain warranty.
4. Color as selected by Architect from manufacturer’s 12 standard colors.
5. Surface texture shall be hammered.

D. Resilient Moulding/Reducer/Floor Finishing Accessories:
1. Provide vinyl carpet edge guards for glue down applications, nosings for resilient floor covering reducer strip for resilient floor covering, joiner for tile and carpet, or at junction between two dissimilar materials (new/new or new/existing), where shown on drawings and/or required.
a. Provide vinyl carpet edge trim as manufactured by Tandus Centiva, at following locations:
1. LVT to Terrazzo
b. Color to be determined by Architect from manufacturer’s standard colors.
c. Install per manufacturer’s standard specifications to maintain warranty.

E. Adhesives (cements): As recommended by flooring contractor to suit material and substrate conditions.

F. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION:
A. Installer must examine the areas and conditions under which resilient flooring and accessories are to be installed and notify the Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 PREPARATION:
A. Prior to laying flooring, broom clean or vacuum surfaces to be covered and inspect subfloor. Start of flooring installation indicates acceptance of subfloor conditions and full responsibility for completed work.

1. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloors.

2. Perform moisture tests on concrete slabs to determine that concrete surfaces are sufficiently cured and ready to receive flooring.

3. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

3.03 INSTALLATION:

A. General:

1. Install flooring after finishing operations, including painting, have been completed and permanent heating system is operating. Moisture content of concrete slabs, building air temperature, and relative humidity must be within limits recommended by flooring manufacturer.

2. Place flooring with adhesive cement in strict compliance with manufacturer's recommendations. Butt tightly to vertical surfaces, thresholds, nosing and edgings. Scribe around obstructions and produce neat joints, laid tight, even and straight. Extend flooring into toe spaces, door reveals and into closets and similar openings.

3. Maintain reference markers, holes or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking device.

4. Maintain overall continuity of color and pattern with pieces of flooring installed in these covers. Tightly cement edges to perimeter of floor around covers and to covers.

5. Tightly cement flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of
adhesive spreader marks or other surface imperfections.

B. Tile Floors:

1. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.

2. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged. Cut tile neatly to around all fixtures. Broken, cracked, chipped or deformed tile are not acceptable.

C. Accessories:

1. Apply resilient base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in as long lengths as practicable, with preformed corner units or fabricated from base materials with mitered or coped inside corners. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces.

a. On masonry surfaces or other similar irregular surfaces, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.

2. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at all unprotected edges of flooring, unless otherwise shown.

3. Apply resilient accessories at stair systems as indicated and in strict conformance to manufacturer's installation instructions.

3.04 CLEANING AND PROTECTION:

A. Remove any excess adhesive or other surface blemishes, using neutral type cleaners as recommended by flooring manufacturer. Protect installed flooring from damage by covering.

B. Finishing: After completion of project and just prior to final inspection of work, thoroughly clean floors...
C. Apply wax and buff with type of wax, number of coats and buffing procedures, in compliance with flooring manufacturer's instructions.

END OF SECTION 09650
SECTION 09900 - PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

A. The extent of painting work is shown on the drawings and schedules, and as herein specified.

B. The work includes painting and finishing of interior and exterior exposed items and surfaces throughout the project, except as otherwise indicated.

C. The work includes field painting of exposed bare and covered pipe and ducts (excluding color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical work, except as otherwise indicated.

D. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.

E. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers and other applied materials, whether used as prime, intermediate or finish coats.

F. Paint all exposed surfaces in areas designated "paint" in "schedules," except where the natural finish of the material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint them the same as adjacent similar materials or areas.
1.03 PAINTING NOT INCLUDED:

A. The following categories of work are not included as part of the field-applied finish work, or are included in other sections of these specifications:

1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various sections for structural steel, miscellaneous metal, hollow metal work, and similar items.

2. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items as (but not limited to) metal toilet enclosures, acoustic materials, casework, finished mechanical and electrical equipment including light fixtures, switchgear and distribution cabinets, but not light or power panels where exposed elevator entrance frames, doors and equipment.

3. Concealed surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas.

4. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, unless otherwise indicated.

5. Operating Parts and Labels:

a. Moving parts of operating units, mechanical and electrical parts such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting unless otherwise indicated.

b. Do not paint over any code-required labels, such as Underwriters', Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

1.04 SUBMITTALS:
A.  Product Data:

1.  For information only, submit 2 copies of manufacturer's technical information including paint label analysis and application instructions for each materials proposed for use. Transmit a copy of each manufacturer's instructions to the paint Applicator.

B.  Samples:

1.  Submit samples for Architect's review of color and texture only. Compliance with all other requirement is the Exclusive responsibility of the Contractor. Provide a listing of the materials and application for each coat of each finish sample.

   a.  On 12" x 12" hardboard, provide two samples of each color and material with texture to simulate actual conditions. Resubmit each sample as requested until acceptable sheen, color and texture is achieved.

   b.  On actual wood surfaces, provide two 4" x 8" samples of each stained wood finish as required. Label and identify each as to location and application.

1.05  DELIVERY AND STORAGE:

A.  Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and the following information:

1.  Name or title of material.

2.  Fed. Spec. Number, if applicable.

3.  Manufacturer's stock number and date of manufacturer.

4.  Manufacturer's name.

5.  Contents by volume, for major pigment and vehicle.

7. Thinning instructions.
8. Application instructions.
9. Color name and number.

1.06 JOB CONDITIONS:

A. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F. and 90 degrees F., unless otherwise permitted by the paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F. and 95 degrees F. unless otherwise permitted by the paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds 85% or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.

1. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.01 COLORS AND FINISHES:

A. Prior to beginning work, the Architect will furnish color chips for surfaces to be painted. Multiple colors will be used and colors will vary from wall to ceiling and from room to room. Final selection for gloss level will be by Architect and may not necessarily be the same as scheduled.
   1. Use representative colors when preparing samples for review.
   2. Final acceptance of colors will be from samples applied on the job.

B. Color Pigments: Pure, non-fading, applicable types to
suite the substrates and service indicated.

C. Paint Coordination: Provide finish coats which are compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information on characteristics of finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and reprime as required. Notify the Architect in writing of any anticipated problems using specified coating systems with substrates primed by others.

2.02 INTERIOR PAINTING SCHEDULE:

A. Concrete/Masonry Surfaces (Semi-Gloss) (Vinyl Acrylic Latex System)

1. Primer: Vinyl Acrylic Block Filler
   Benjamin Moore: Moorcraft interior and exterior block filler #173

2. Finish Coats: Vinyl Acrylic Semi-Gloss Enamel (25-35 units at 60 degrees F.), 1.5 DFT/coat.
   Benjamin Moore: (2) coats Moorcraft latex semi-gloss enamel #1416

B. Concrete/Masonry Surfaces (Semi-Gloss): (Water Based Epoxy - Normal Exposure) in areas as noted on Room Finish Schedules.

1. Primer: 100 percent Acrylic Resin Block Filler, .075 - 1.0 DFT/coat.
   Benjamin Moore: Waterborne block filler (M31/32)

2. Finish Coats: Water Based Epoxy, Semi-Gloss (20-30 units at 60 degrees F.) 3 mils DFT/coat.
   Benjamin Moore: (2) coats acrylic epoxy (M43/44)

C. Metal-Ferrous (Semi-Gloss): (Alkyd Enamel System, Maximum VOC content 450 grams/liter)

1. Primer: Modified Alkyd Resin Primer, 3 mils DFT/coat
   Benjamin Moore: iron clad retardo rust inhibitive paint, 163
2. Finish Coats: Alkyd Enamel, Semi-Gloss (40-50 units at 60 degrees F.) 3.0 mils DFT/coat. Benjamin Moore: (2) coats satin impervo

E. Gypsum Board (Semi-Gloss): (Acrylic Latex System)
   1. Primer: Vinyl Acrylic Latex, 1.1 mils DFT/coat
      Benjamin Moore: Moorcraft undercoater (284)
   2. Finish Coats: Vinyl Acrylic Semi-Gloss (25-35 units at 60 degrees F.), 1.5 mils DFT/coat.
      Benjamin Moore: (2) coats Moorcraft latex semi gloss (276)

G. Gypsum Board (Semi-Gloss): (Water Based Epoxy System)
   1. Primer: Vinyl Acrylic Latex, 1.1 mils DFT/coat
      Benjamin Moore: Moorcraft undercoater (284)
   2. Finish Coats: Water Based Catalyzed Epoxy, Semi-Gloss (20-30 units at 60 degrees F.), 2.5 - 3.0 mils DFT/coat.
      Benjamin Moore: (2) coats acrylic epoxy (M43/44)

H. Painted Woodwork:
   a. 1st Coat-Enamel undercoat (TT-S-543)
   b. 2nd Coat-Alkyd enamel (TT-E-509)
   c. 3rd Coat-Alkyd enamel (TT-E-509)

I. Stained Woodwork:
   a. 1st Coat-Interior oil stain (TT-S-711)
   b. 2nd Coat-Bleached shellac (TT-S-300)
   c. 3rd Coat-Rubbing varnish (TT-V-86)
   d. 4th Coat-Rubbing varnish (TT-V-86)
   e. Fill open grained wood with filler complying with TT-F-336 and wipe before first varnish coat.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Applicator must examine the areas and conditions under which painting work is to be applied and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions
have been corrected in a manner acceptable to the Applicator.

B. Starting of painting work will be construed as the Applicator's acceptance of the surfaces and conditions within any particular area.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

3.02 SURFACE PREPARATION:

A. General:

1. Perform preparation and cleaning procedure in strict accordance with the paint manufacturer's instructions and as herein specified for each particular substrate condition.

2. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.

3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly-painted surfaces.

B. Cementitious Materials:

1. Prepare cementitious surfaces to be painted by removing all efflorescence, chalk, dust, grease, oils, and by roughening as required to remove glaze conforming to SSPC SP13.

2. Determine the alkalinity and moisture content of
the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint. Do not paint over surfaces where the moisture content exceeds that permitted by the manufacturer's printed directions.

C. Wood:

1. Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of the priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.

2. Prime, stain, or seal wood required to be job painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling, etc.

3. When transparent finish is required, use spar varnish for backpriming.

4. Seal tops, bottoms, and cut-outs of unprimed wood doors with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.

D. Ferrous Metals:

1. Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning, conforming to SSPC SP-1 and SSPC SP-2, SSPC SP-3 or SSPC - SP7/NACE - No. 4 (brush off blast cleaning)
E. Galvanized Surfaces:

1. Clean free of oil and surface contaminants with an acceptable non-petroleum based solvent per SSPC SP-1.

3.03 MATERIALS PREPARATION:

A. Mix and prepare painting materials in accordance with manufacturer’s directions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and if necessary, strain the material before using.

3.04 APPLICATION:

A. General:

1. Apply paint in accordance with the manufacturer’s directions. Use applicators and techniques best suited for the substrate and type of material being applied.

2. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

3. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.

4. Paint interior surfaces of ducts where visible through registers or grilles with a flat, non-
specular black paint.

5. Paint the back sides of access panels and removable or hinged covers to match the exposed surfaces.

6. Finish exterior doors on tops, bottoms and side edges the same as the exterior faces, unless otherwise indicated.

7. Sand lightly between each succeeding enamel or varnish coat.

8. Omit the first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. Scheduling Painting:

1. Apply the first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness:

1. Apply each material at not less than the manufacturer's recommended spreading rate to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

D. Mechanical and Electrical Work:

1. Painting of mechanical and electrical work is limited to those items exposed in occupied spaces and includes all exterior exposed work.

E. Prime Coats:
1. Apply a prime coat of material which is required to be painted or finished, and which has not been prime coated by others.

2. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

F. Pigmented (Opaque) Finishes:
   1. Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

G. Transparent (Clear) Finishes:
   1. Use multiple coats to produce glass-smooth surface film of each luster. Provide a finish free of laps, cloudiness, color, irregularity, runs, brush marks, orangpeel, nail holes, or other surface imperfections.

   2. Provide satin finish for final coats, unless otherwise indicated.

H. Completed Work:
   1. Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.05 CLEAN-UP AND PROTECTION:

A. Clean-up:
   1. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

   2. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and
scraping, using care not to scratch or otherwise damage finished surfaces.

B. Protection:

1. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing and repainting, as acceptable to the Architect.

2. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

3. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

END OF SECTION 09900
SECTION 10400 - IDENTIFICATION DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.02 SUMMARY

A. Provide labor, materials, and equipment necessary for the complete installation of identifying devices as indicated, including:

   1. Interior Signage
   2. Interior Acrylic Logo Sign

1.03 SUBMITTALS:

A. Submit product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Submit Shop Drawings showing fabrication and erection of signs. Include plans, elevations, and large scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.

C. Signage shall have 2 colors, background and letters. Match sample provided by Architect.

D. Provide samples for verification of color, pattern, and texture selected and compliance with requirements indicated:

   1. Cast Acrylic Sheet: Provide a sample panel not less than 8-1/2 inches by 11 inches for each material, color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.
1.04 QUALITY ASSURANCE:


B. Signage shall be provided to conform with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

A. Manufacturers: (Interior Signage) Subject to compliance with requirements, provide signage by one of the following:

1. ASI Sign Systems, Indianapolis, Indiana; Cincinnati, Ohio; Cleveland, Ohio
2. Jacob Design, Grand Rapids, Michigan
3. Diskey Sign Corp. Fort Wayne, Indiana
4. Andco Industries Corp. Greensboro, North Carolina
5. Southwell Company, San Antonio, Texas
6. Roban, Lakemore, Ohio
7. Best Signs, Montrose, Colorado
8. Bayuk Graphic Systems, Inc. (CW Series)
10. OpenLight

B. Manufacturers: (Exterior Pin Mounted Building Signage) Subject to compliance with requirements, provide signage by one of the following:

1. Metal Arts Division of L & H Manufacturing Company, Mandan, North Dakota
2. Other Architect approved equal.

C. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect’s approval must be accompanied by the “Substitution Request Form” and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

1. Refer to Section 00100 - Instructions to Bidders and Section 00121 - Substitution Request Form for additional requirements.
2.02 MATERIALS:

A. Cast Acrylic Sheet: Provide cast (no extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 degrees F and of the following general types:
   1. Thickness: 1/8 inch.
   2. Colors: TBD

B. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.

C. Anchors and Inserts: Use nonferrous metal or hot dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete masonry work.

D. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background color that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

2.03 INTERIOR SIGNAGE:

A. Signage, General:

1. Graphic Process: Raised letters and Braille shall be formed as an integral part of the sign face. Surface applied letters and Braille are not allowed.

2. Letters: Letters and numbers shall have width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10. Letters and numbers shall be raised 1/32 inch, uppercase, sans serif or simple sans serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be 5/8 inch high minimum and 2 inches high maximum.

3. Ease sign edge and radius corners 3/8 inch.

4. Material
   a. Acrylic plastic

5. Size: 8” x 8” or match existing sign sizes and profiles in building.
B. Interior Room Name and Number Signs

1. Layout of room name and number shall be as directed by the Architect.
2. Number of signs required: a. Rooms indicated on Signage Schedule on drawings.

2.04 INTERIOR PIN MOUNTED SIGNAGE:

A. Provide 1-3/4” minimum mounted distance/projection from the wall face (mounting type PMS-3). Provide with all required stainless steel accessories for a complete installation.

B. Letter size shall be 8”H and style shall be Helvetica font.

C. Acrylic individual letters in color as selected by Architect.

D. Provide lettering to be mounted above entry doors as follows: (Verify exact location in field with Architect)
   1. CAFETERIA (2 required)

2.03 INTERIOR ACRYLIC LETTERS AND LOGO SIGNS:

A. Cast Acrylic Sheet: Provide cast (no extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 degrees F and of the following general types:
   1. Thickness: 1/4 inch in sizes as noted on drawings.
   2. Colors to be determined.
   3. Camera ready artwork of logo to be supplied by Owner.

B. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface. NOTE: Provide pins of varying lengths for mounting to radius surfaces. Verify lengths required in field.

C. Anchors and Inserts: Use nonferrous metal or hot dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, where letters and logos are to be set into concrete masonry work.

D. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background
color that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. General: Located sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer’s instructions.
   1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Wall Mounted Panel Signs: Attach panel signs to wall surfaces using the method indicated below:
   1. Mount with adhesive as recommended by manufacturer.
   2. Mount with nonremovable oval head screws, using plastic plugs where mounted on masonry.

3.02 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer’s instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION 10400
SECTION 10999 - MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

A. The extent of miscellaneous specialties is as shown on the drawings or schedules and includes the following:

1. Sliding security grille
2. Stainless Steel

1.03 SUBMITTALS:

A. Product Data:

1. Submit two (2) copies of manufacturer's specifications and installation instructions for each type of specialty required. Indicate by transmittal that copy of each instruction has been distributed to the Installer.

B. Samples:

1. Submit three (3) samples of each color and finish of exposed materials and accessories required for each specialty. Architect's review of samples will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

C. Shop Drawings:

1. Submit shop drawings for fabrication and erection of specialties, including plans, elevations and large scale details, shop anchorages and accessory items. Provide location template drawings for items supported or anchored to permanent construction.
PART 2 - PRODUCTS

2.01 PREFABRICATED PRODUCTS:

A. Sliding Security Grille

1. Furnish and install size noted on Drawings, bi-parting sliding aluminum security grille, Cornell ESG30, or equal by Alumatek, Cookson, Mahon, McKeon Kinnear/Wayne-Dalton, Overhead Door Company, or equal approved in advance by the Architect-Engineer.

2. Grille curtains to have 9" horizontal link spacing.

3. Overhead track shall be extruded aluminum 1-1/2"W x 1-7/8"H, curved where required.

4. Operation shall be manual. See drawings for opening sizes.

5. Finish all aluminum with clear anodized finish.

6. Provide cylinder lock at both sides of jamb with full height strike and drop bolt for bi-parting doors. Stainless steel floor strike shall be dustproof.

7. Provide with optional pocket doors at each end (at the stacking pockets).

8. Trailing end member shall be floating in pocket.

B. Stainless Steel

1. Shall be type 304 having a standard analysis of 18% chrome and 8% nickel. Stainless steel to be as manufactured by Republic Steel Company, “Endure”, Allegheny Metal Company, Crucible Steel Company, “Rezistal” or approved equal. Gauge to be specified under item specifications and furnished with #4 satin finish, rounded edges and ¼” min. returns, unless otherwise specified.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Installer must examine the substrates and conditions under which the specialties are to be installed, and notify the
Construction Manager and Architect in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION:

A. In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for preparation of substrate, installation of anchors, and application of specialties. Coordinate with work of other trades for application of inserts of other integral equipment items.

B. Install at the locations shown or scheduled, securely mounted with concealed fasteners, unless otherwise shown. Attach to substrates in accordance with the manufacturer's instructions, unless otherwise shown.

C. Install level, plumb and at the proper height. Cooperate with other trades for installation in finish surface. Repair or replace damaged units as directed by the Architect.

END OF SECTION 10999
SECTION 11400 – FOOD SERVICE EQUIPMENT

GENERAL REQUIREMENTS

RELATED DOCUMENTS

The general provisions of the Contract, including instructions to bidders, General Conditions, Supplementary Conditions, General Requirements, apply to the work specified in this section.

1. DESCRIPTION

The fabrication requirements attached are a governing part of this specification and shall be consulted for all matters pertaining to the work. When references are made to FSEC, the same shall be construed to designate the Food Service Equipment Contractor.

The FSEC is to provide all items, articles, materials, transportation, operations, and methods listed, mentioned, or scheduled on the drawings and specifications, including all labor, materials, equipment, and incidentals necessary and as required for their completion.

2. QUALITY ASSURANCE

Brands and Names

The manufacturer's catalog designations used in the following specifications are intended to illustrate and represent the standards which will be required by the Owner. Bidders are to list, by item number, manufacturer's name and quantities on itemized proposal form attached to the specifications for approval by the Owner. When not attached, the FSEC shall make up his own itemized list and submit same attached with his bid. NOTE! Base Bid must be on fixtures specified for fair comparison of all bids.

Substitutions

Substitutions by any bidder wishing to supply alternate equipment other than that specified may submit a separate itemized proposal on similar articles of other manufacturers of
the same standard performance, capacity, size, durability and appearance but must accompany their alternate proposal with complete descriptive literature of the item quoted.

Owner and Architect reserve the right to accept or reject such proposed substitutions. Bidders recommending such substitutions are cautioned to examine the mechanical plans that may have already been approved and conditions at the building site to determine if such substitutions require changes in mechanical connections already planned or installed.

If the proposed substitutions require such changes, the Bidder shall include the cost of same in his bid and call it to the attention of the Architect and Owner by including a descriptive notation in his bid.

Discrepancies

Where model numbers, quantities, sizes or gauges of material differ on plans and specifications, it shall be understood that the FSEC shall figure the larger quantities, longest size and heavier gauge unless advised otherwise in writing.

Where an accessory or piece of equipment is shown on elevation or plan, it shall be deemed part of the Food Service Contract, even if it is not listed in the Item Specifications.

Where an item is listed in Item Specifications and not shown on plan or elevations, the item shall be deemed part of the Food Service Equipment Contract.

Measurements

All dimensions given on bidding documents are approximate and are as accurate as can be determined at the time. The Equipment Contractor shall check all measurements at the building prior to fabrication of equipment and shall bring any deviation from the dimensions shown or required by building conditions to the Consultant's attention. All equipment must conform to the finished building conditions. Where obstructions occur, equipment must be neatly scribed fitting to and around same resulting in a sanitary fixture.

Prior to fabrication, the Consultant or the Owner reserves the right to require the Contractor to make reasonable modifications.
in the routing of the work and relocation of the equipment. This specifically refers to conditions where interference occurs or where materials cannot be installed because of structural or mechanical conditions encountered. The Contractor will receive no additional compensation for such work.

Ordinances

Work and materials shall be in full accord with the latest rules of U.S. Public Health Service, National Board of Fire Underwriters, O.S.H.A., local and state ordinances, State Accident Commissions Safety Ordinances, regulations of the Bureau of Fire Services and with prevailing ordinances.

Ordinances including building codes, gas codes, steam codes, and other codes applying to this contract shall be followed.

All applicable items shall conform to latest Standards Revisions established by the National Sanitation Foundations, (N.S.F.), Ann Arbor, Michigan.

Electric operated and/or heated equipment, fabricated or otherwise shall conform to the latest standards of National Electric Manufacturer's Association, Underwriters Laboratories, Inc., National Electric Code or local standards such as to be acceptable to authorities having jurisdiction.

Standard steam heated equipment shall be manufactured in accordance with A.S.M.E. code requirements and carry the A.S.M.E. stamp.

Burners for gas heated equipment shall be equipped with automatic lighters. Oven burners and other concealed burners shall have automatic safety pilots and conform to A.G.A. standards. All gas equipment is to be furnished with appliance pressure regulators.

The drawings and specifications shall govern whenever they require longer sizes or higher standards than are required by the ordinances.

The Ordinances shall govern whenever drawings and specifications require something which will violate the ordinances.
No extra change will be paid for furnishing items required by local and state ordinances not specified or shown on drawings. Rulings and interpretations of the enforcing agencies shall be considered as part of the ordinances.

Should any change in the drawings and specifications be required to conform to the above, the Architect shall be notified when bid is submitted.

After entering into contract, all necessary work shall be done to meet above laws, ordinances, Bureau of Fire Services requirements, etc., without additional expense to the Owner.

Samples

Samples of all hardware, locks, feet, brackets, and other materials that may be requested shall be submitted for approval before use.

Scheduling of Work

The work shall be scheduled so there will be no interference with work of other trades and so that it will cause no delay. A time schedule will be worked out for the entire building and this work shall keep pace with the set schedule, working nights, Sundays and holidays, if necessary, to complete the work within the time limit.

3. SUBMITTALS

All submittals to be reviewed, stamped and dated by FSEC prior to sending them to the Contractor, Architect and Consultant. Submittals not bearing the FSEC’s stamp will be rejected.

FSEC shall submit required number of drawings, brochures and portfolios of all equipment, apparatus, materials, etc., which are applicable to this contract together with detailed specifications. Each piece of equipment, apparatus, and accessory to be checked by the FSEC to insure compliance with requirements of Architect's drawings and specifications and also brochures or any other item of information to be clearly marked for identification with respect to their application and installation locations. This specification page shall appear on every shop drawing.
Approval and/or review of shop drawings, details, and equipment by the Consultant is for design and concept only and does not relieve the FSEC of responsibility for compliance with design drawings, details and specifications, verification of all dimensions of equipment and building conditions and reasonable adjustments due to deviations.

While the Architect's drawings and specifications propose to be complete in all respects as to layout, type of equipment and materials, they are not intended to serve as detailed sleeve or insert drawings, and preparation of such drawings, required or necessary for this purpose, or to set equipment accurately, are to be the responsibility of the FSEC.

FSEC shall submit drawings of all custom fabricated equipment within thirty (30) days after notification of contract award. Drawings to be accurately laid out and correlated with other contractors work and latest architectural final construction plans. Equipment elevation shop drawings must be on 3/4" scale (3/4" = 1'-0").

Drawings to show detailed construction for each piece of equipment. Before submitting detail drawings for review, they must be checked by the FSEC with the specifications and shall show exactly how item will be fabricated. Construction of equipment shall not deviate from approved shop drawings without written approval from the Architect and/or Food Service Consultant.

FSEC shall submit rough-in drawings for approval at a scale of 1/4" = 1'-0", locating accurately all utility connections for each item of equipment requiring the same. Rough-in plan to be drawn up using final architectural building drawings. NOTE! All rough-in connections to conform with normal acceptable standards. Rough-in requirements for present or future food service equipment shall be included on all drawings.

FSEC 1/4" scale rough-in drawings are to be dimensioned from ends of finished walls. Shop drawings with dimensions from centerline of columns will not be accepted, unless approval has been given by Architect, Consultant or the General Contractor.

Drawings showing all dimensions of bases or platforms and depressions to be submitted on a scale of 1/4" = 1'-0".
Rough in connection notes are not to be listed under numbered rough in schedule, except for general purpose outlets or where drawing space is limited.

Equipment rough in plans are to be furnished complete with layout plan and item schedule similar to food service consultants drawings. Plumbing, electrical, ventilation & depression plan, and base detail when required.

Plumbing and electrical plans are to be on separate sheets when drawings are prepared at 1/4" scale. NOTE! Food Service Consultants documents are not to be traced.

Manufacturers to strictly adhere to approved and reviewed drawings, except where field conditions require changes and in that event the Architect must be notified in writing.

Manufacturing of any equipment fitting between walls or between columns and walls to be withheld until actual field dimensions are set and approved by the General Contractor. All other items which do not require field dimensions are to be manufactured upon receipt of reviewed shop drawings.

Upon completion of contract, the contractor is to deliver to the Owner two (2) complete sets of final working drawings and two (2) portfolios of purchased equipment bound in a binder. A time schedule will be worked out for the entire building and this work shall keep pace with set schedule, working nights, Sundays, and holidays, if necessary, to complete the work within the time limit.

4. **Job Conditions**

Job Meetings

It shall be the responsibility of the FSEC to have a qualified representative at all monthly or special job meetings to help the Architect and other contractors on the job to correlate work or answer questions so that the job can progress without any obstructions.

Examination of Premises

FSEC to check the Architectural Contract Plans and visit the premises at a suitable time to determine maximum size of
equipment he can safely get into the building in one piece. Field joints to be held to a minimum. Should door openings not be large enough, FSEC shall provide field joints in equipment as required and re-weld inside of building.

Utilities Services

Rough-in cold water, hot water, waste and vent piping, duct work and electrical wiring to be installed by Plumbing and Electrical Trades. Such items are to be brought away from surface of floors, walls and/or ceilings by these Trades and capped prior to installation of food service equipment.

5. GUARANTEE

FSEC is to furnish one (1) year written guarantee for equipment starting from date of acceptance by the Owner or the Owner’s duly authorized representative. Guarantee to be in accordance with Architect’s General Conditions.

Refrigeration - Self-contained

All self-contained refrigeration compressors for milk coolers, ice cream cabinets, cold food counters, reach in refrigerators or freezers, etc., shall be furnished with a five (5) year compressor warranty and one (1) year refrigeration service starting from date of final acceptance.

6. PRODUCTS

Fabrication Requirements - See following page for details

All food service equipment is to be constructed in strict compliance with the latest standards of the National Sanitation Foundation and to meet all requirements of the local and State Health Regulations. All equipment to bear the N.S.F. seal of approval.

Welding

The words "weld", "welded", or "welding" as used in the item specifications, mean a metal joint continuously welded then all exposed parts ground smooth and polished to match adjoining surfaces.
All welding to be done in a thorough manner with welding rod of same composition as sheets or parts welded. Welds to be strong, ductile with excess metal and discoloration ground off and joint finished smooth to match adjoining surfaces.

Welds to be free of imperfections such as pits, runs, splatters, cracks, warping or discoloration. All welded joints to be homogeneous with parent metal itself. All fabricated equipment items where metal to metal butt joints occur to be joined and properly welded then ground and polished smooth.

Grinding, Polishing and Finishing

All exposed welded joints to be ground flush with adjoining material and neatly finished to harmonies therewith.

Whenever material has been depressed or sunken in by welding operations, such depressions shall be suitably hammered and peened flush with adjoining surfaces to then be polished and/or buffed to match adjoining surfaces to a degree consistent with good workmanship. Care shall be exercised in all grinding operations to avoid excessive heating of metal and metal discoloration. Abrasive wheels and belts used in grinding to be iron free and not having been used on carbon steel. In all cases, the grain or rough finish to be removed by successively finer polishing operations to be consistent with reasonable care and good workmanship. Final polishing operations to be uniform and smooth.

Where break band occurs, free of open texture or orange peel appearance, all such marks shall be removed by grinding, polishing and finishing. Wherever sheared edges occur, they shall be free from burrs, projections and fins to obviate all danger from cutting or laceration when hand is drawn over such sheared edges.

Where miters or bullnosed corner, they will be neatly ground to uniform condition and in no case will overlapping materials be acceptable.

Equipment quality finish consistent with high grade of manufacturing practiced in industry. All exposed surfaces to be commercial mill finishes known as #4 satin finish for corrosion.
resistant steel. All exposed edges to be furnished with a #7 mirror finish, unless otherwise noted in item specifications.

All cabinets, doors and shelves where exposed to be interpreted as meaning inside surface exposed to view when swinging door or sliding doors are opened. Unless otherwise specified, underside of shelves need not be satin finish.
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FERNDALE HS-KITCHEN/SERVING LINE AND CAFETERIA RENOVATION
171745
JANUARY 12, 2018

FOOD SERVICE EQUIPMENT 11400 - 10

STANDARD EDGE DETAILS

NO SCALE
Doors - Hinged

To be full height of door opening. Each door shall not be over 30" wide for high cabinets and 24" wide for low cabinets. Doors to be double pan construction flush type and braced and thoroughly sound deadened made of 18 ga. st. st. Inner and outer pans to be sealed with 3/4" long tack welds spaces approximately 6" apart. Balance of the space to be completely sealed between tack welds with silver solder or N.S.F. approved hard solder (Silicone not approved).

All welds ground and polished smooth. All bracings to be on proper centers to fit door size.

Doors to be mounted on heavy semi concealed nickel bronze olive knuckle hinges fastened to inside ledge of door and cabinet so that only pin will be exposed to heavy st. st. piano hinges. Provide each door with Component Hardware #M22-2420.

Doors - Sliding

Make same as specified for hinged doors, except they shall operate on Component Hardware #B58-5513 and #B58-5523 nylon tire wheels running on one (1) piece drawn aluminum overhead Component Hardware #B57 tracks. Bottom shall be guided by st. st. Component Hardware #B56-1096 guide pins at center of door openings. Provide locks where called for in item specifications. Provide flush type polished handles. (Heated cabinets with sliding doors to use Component Hardware #B58-5511 and #B58-5523 st. st. ball bearing wheels).

"High" type fixtures to be fitted with two (2) sets of doors in height, each set opening into half height of fixture.

"Low" type fixtures to be fitted with (1) set of full height doors. No door length to exceed 36".

Sinks

All sinks to be made of 14 ga. st. st. unless otherwise specified. All corners shall be coved at least 5/8" radius, with all corners and joints welded, ground and polished smooth to a #4 satin finish. Sinks, unless otherwise specified, shall not be less than 14" deep. The use of solder or separate filler
pieces to obtain coved corners will not be acceptable. All sink bottoms are to be integrally pitched to insure complete drainage of sink to waste opening. Edges at table height to have exposed edges formed to match adjoining table. Edges adjacent to table to be welded to table with all welds ground and polished smooth.

Unless otherwise specified, all sinks to be provided with backsplash 12" high x 2-1/2" wide to allow for pipe space in rear. Flange over at ends, with top edge turned back 2-1/2" at 45 degree angle and down 1". Provide openings for combination swinging type water faucet for each compartment.

In sinks of two (2) or more compartments, furnish between each sink compartment a 3/4" wide full height portion integrally welded to sinks at front, back and bottom maintaining smooth 5/8" radius coved corners as described in preceding paragraph.

Front of multiple compartment sinks shall consist of st. st. apron same gauge as sinks having length same as overall length of sink bowls and same depth as bowls. This apron shall be "L" shaped and welded to or part of the top rim.

Design of apron front to be such that sinks shall have an appearance of a continuous one (1) piece front face of all overlapping joints and open spaces between sink compartments.

Each compartment to be furnished with Component Hardware rotary handle type drain, connected rear overflow, 6" tailpiece and faucet of make and model number as called for in Item Specifications. Also each sink to be furnished with 14 ga. st. st. waste handle bracket welded to underside of sink.

**Tables & Tops - Height**

All working tops to be 34" high from floor, unless otherwise stated under specific item.

**Metal Tops**

Unless otherwise specified in Item Specifications, metal tops to be 14 ga. st. st. reinforced and braced on underside by framework consisting of 1-1/2" x 1-1/2" x 3/16" angles and 1" x 3" x 3/16" channels, galvanized where concealed and st. st. where exposed.
Framework angles to run full length and width and with angle crossbrace on not over 2'-6" centers. Channel reinforcing to run full length of tops down center of top. All tops with sinks shall be integrally pitched towards same.

All joints of framework to be welded with weld re-metalized. Tops to be bolted to framework in a concealed manner with st. st. bolts similar to AN-COR-LOX cup nuts. All metal tops to appear as one piece with all field and shop joints reinforced and welded, ground smooth, and polished, also to be made of largest piece obtainable.

No short pieces of metal will be acceptable. St. st. tops to have a #4 satin finish and all tops of this metal to be full 1/2" cove at re-entrant corners, also where turned up in rear or in front, such as dishtables. Solder filled corners will not be acceptable.

Metal edges to be made as described below and/or shown on detail drawings. Top to have all edges turned down 1-3/4" then back 1/2" at a 70 degree angle all around with all corners welded, ground, and polished smooth with no cracks or openings showing. All exterior corners to be well rounded bullnosed in 1-1/4" radius.

Dishtables & Pot Washing Tables

All free edges to be turned up 2-3/4" then rolled to 1-5/8" x 180 degrees and furnished with apron edge front, as per Edge Detail Sheet. All exposed and exterior corners to be coved at 5/8" radius with all joints welded, ground, and polished smooth.

Where tables abut a wall or other tall equipment, extend back and/or ends up 12" then back 2-1/2" at 45 degrees and down 1" parallel to wall. Provide with end filler pieces and all welded surfaces ground and polished smooth.

The underside of Dish and Pot Washing tables to be reinforced with 1-1/2" x 1-1/2" x 3/16" st. st. angles and 1" x 3" st. st. channels. Angles to run full length of tops at both front and rear of tops with crossbrace front to back on 2'-6" centers. Channel bracing to run down center, full length of tops. Tops shall be integrally pitched to dishwasher and sinks.
Fastening Tops to Washers and Other Equipment

Where tops are shown adjacent to dish or glass washer, etc., ends are to be turned down 1-1/2" into fixture and bolted tightly to it with approved gaskets between body and turned down edges. Backsplashes to have edge against fixture turned out 1-1/2" and tightly fitted to it. Free edges to be neatly fitted to fixture corners to prevent water from dripping on floor. All tops to have integral pitch to drain towards dishwasher.

Dish & Pot Table Drainage

During installation of dish tables and dishwasher, FSEC shall water test all counter tops to make sure of proper pitch before final plumbing and electrical connections are made. All water on counter tops shall drain with no standing puddles allowed. Should the FSEC fail to pitch tables properly, he shall be responsible for disconnecting plumbing and electrical connections and re-adjust tables to insure proper pitch. FSEC shall also be responsible for re-connecting all service lines after tables have been re-aligned.

Pipe Stands

All equipment requiring pipe legs or stands to be provided with sufficient supports to carry superimposed load of 100 lbs. per sq. ft. Top to be fabricated of 16 ga. st. st. Tubing to be Component Hardware #A46-5288 complete leg assembly Model Number 2236HB, 1-5/8" O.D., with st. st. hex head bullet shaped feet as previously specified. All pipe stands to be braced with crossrails, Component Hardware #A46-4288, 1-5/8" st. st. pipe welded to legs approximately 10" above floor or braced by lower shelf as specified hereinafter. Provide Component Hardware #A18-0206 st. st. gussets as previously specified, welded to framework on underside of top.

In place of gussets, st. st. legs may be welded to st. st. channels 5" long which shall fit into channel crossbracing. Flange of both channels to be machine bolted together. Holes for bolts to be slotted for adjustment. Provide legs on not over 5'-0" centers and additional if required or requested.

All pipe legs or vertical members to be set back from table top on ends and on front and back sufficient distance to offset any interference with workers, columns, walls or other items. Where
tops are welded to sinks, omit pipe legs supporting top at sink location.

Shelves Under Tables

Under tops which are mounted on pipe legs or stands, shelves under table to be fabricated of 16 ga. st. st. with all edges flanged down 1-1/2" or as otherwise noted in the Item Specifications. Shelves to fit tightly around contour of legs and welded from underside. Shelves to be made up from long lengths with all joints welded, ground, and polished smooth. Short lengths will not be permitted. Reinforced, as required, to support load of 50 lbs. per sq. ft. All sharp edges, burrs, and corners to be ground smooth and removed and then be slightly rounded. All shelves in cabinet bases are to be angle reinforced.

Cabinet Bases

Exterior cabinet bases to be constructed of 18 ga. st. st. with front face, exposed ends, rear, and corners integrally exposed with all welds ground and polished smooth to form a one piece construction appearance.

St. st. exterior to be mounted over a 1-1/2" x 1-1/2" x 1/8" all welded galvanized iron angle frame. Where st. st. exterior meets angle framework at drawer, door or shelf openings, exterior shall be turned in 1-1/2" over angle framework inside of openings. All drawers and doors to be flush with cabinet face.

All cabinet base bottoms to be enclosed with 18 ga. galvanized iron panels. Interior shelves of cabinet base to be constructed of 16 ga. st. st. and be reinforced with 1-1/2" x 1-1/2" x 1/8" angles. Rear and ends of shelves to be turned up 2" with all interior corners coved to 5/8" radius.

Drawers

Drawer front to be 3/4" thick double pan construction with 16 ga. st. st. telescoping rear panels. Joints to be sealed same as specified for double pan hinged doors. Drawer front fitted with recessed st. st. grip handle, Component Hardware #CAGP63-1012. Drawer to be furnished with 18 ga. galvanized iron bottom
with openings in front to accommodate drawer. Provide with cylinder type lock when specified under Item Specifications or shown on elevation details.

Opening in front to have edges turned in to fit drawer front which will be flush when drawer is closed. Bottom of enclosure to be open with edges turned in 1" on all sides.

All corners on enclosure to be continuously welded, then polished and ground smooth. Exposed rivets or screws will not be acceptable. Component Hardware #S81-2020 Drawer insert to consist of removable die-stamped 18 ga. st. st. pan approximately 20" square x 5" deep. Top edges of drawer insert to be flanged out on all sides, not less than 1/2" for resting on drawer extension glides. All sharp edges and burrs to be removed from drawer flange.

Housing supports to be made of 12 ga. st. st. formed into angles welded to underside of metal tops or screwed to underside of wood tops and to extend full width of top with rear enclosure, where exposed. All welded items to be ground and polished smooth. Screws for wood tops to be st. st. countersunk. Drawer housings to slide on 14 ga. st. st. telescoping channels with st. st. rollers, Component Hardware #S52 series extension roller slides.

**Drawers**

This mechanism must be designed so that drawer will not tilt when fully opened. Provide with stop mechanism to prevent pulling the housing from slides but with suitable extension so it may be removed for cleaning.

**Tier of Drawers**

To be two (2) or three (3) in number of same size as specified for above and entirely enclosed with 18 ga. st. st. same as specified under cabinet bases with openings for drawers with all joints flush welded, grounded, and polished smooth.

Single drawers under table tops to be one inch (1") back of edge of fixture. All draws shall have front flush with cabinet body.
Fasteners

Exposed screw or bolt heads will not be permitted on fixtures. Rivets, if specified, shall be countersunk flush. Rivets to be same material as they join. Butt joints made by riveting straps under seams and then filling with solder or caulking will not be permitted or accepted.

Name Plates

All buy-out equipment shall be furnished with a permanently affixed metal name plate listing manufacturer's name, model number, voltage, cycle, phase, horsepower, etc., in an easily readable location. Dealers, installers, fabricators or service agencies name plate stickers shall not be fastened to any item without the approval of the Architect or Consultant.

7. MATERIALS AND WORKMANSHIP

Unless otherwise specified, all material shall be new and of best quality, perfect, and without flaws and shall be delivered upon completion in an undamaged condition.

Stainless Steel

Shall be type 304 having a standard analysis of 18% chrome and 8% nickel. St. st. to be as manufactured by Republic Steel Company, "Endure", Allegheny Metal Company, Crucible Steel Company, "Rezistal" or approved equal. Gauge to be specified under Item Specifications and furnished with #4 satin finish, unless otherwise specified.

Galvanized Iron

Shall be American Rolling Mills "Armco", Republic Steel, Inland Steel, "Tocan" or approved equal.

Pipe legs shall be Standard-Keil #2235HB, 16 ga. st. st. (0.65" thick), tubing furnished with st. st. adjustable foot and Standard-Keil #481-58 with enclosed gusset welded to underside of table top reinforcing channel.

Tubing to be seamless drawn, ground, and polished smooth to a #4 satin finish. Bottom of legs to be swedged for close fit to
adjustable foot. Where space permits furnish 1-1/4" dia. st. st. crossrails welded to leg uprights. All welds shall have radius corners and be ground and polished smooth to a #4 satin finish.

**Handles, Hinges & Door Fasteners**

All hardware and other fittings used in connection with the equipment to be cast nickel bronze or st. st. Handles to be welded or bolted to the equipment in a concealed manner. Bolts to be st. st. and hinges to be recessed in door with st. st. Component Hardware #M75-1002 lift-off, N.S.F. approved hinge. Hinges to be fastened in place with st. st. recessed rivets or welded in place with weld ground and polished smooth.

Sliding doors to be depressed type and furnished with Component Hardware Model #P62-1010 handles. Hinges to be olive knuckle, semi concealed type of nickel bronze or st. st. piano type as described under the specific item.

**Painting and Coating**

All metal that is not st. st. is to be painted with two (2) coats of an approved rust-proof paint such as Rustoleum or other approved equal of highest quality gray enamel.

**Electric Receptacles**

All 120V-1 phase duplex receptacles in cabinet bases to be Pass & Seymour Model #6307 and receptacles over 120 volt shall be Hubbel receptacles sized as per the rough-in drawings.

All receptacles are to be grounded type being both dust and moisture proof. Furnish outlets with st. st. face plates and neoprene mats. In cabinet bases, all receptacles are to be mounted in Chase #R-1 all coved corners st. st. recessed type enclosure mounted to cabinet base. Component Hardware #R73 - 1210 receptacles shall be pre-wired by FSEC to junction box in bottom of base cabinet left ready for final connection by Electrical Trades. All wiring between receptacles and junction box to be run in rigid conduit.

All counter top receptacles to be Component Hardware #R58 chrome plated type as specified in Item Specifications. Counter top receptacles to be pre-wired to junction box in rigid conduit same as previously specified. All wiring to be in strict
compliance with latest standards of the National Sanitation Foundation and Board of Health Requirements.

Quietness of operation of all food service equipment is a requirement and the FSEC shall be required to remove or repair any equipment producing objectionable noises.

Shop Drawing Review

All submittals to be reviewed, stamped and dated by FSEC prior to sending them to the Contractor, Architect and Consultant. Submittals not bearing the FSEC’s stamp will be rejected.

By reviewing and submitting shop drawings and samples, the FSEC thereby represents that he has verified all construction criteria, materials, catalog numbers and similar data and that he has checked and coordinated each shop drawing and sample with the requirements of the work and of the contract documents.

If shop drawings and/or samples are submitted without proper identification and in the Consultant's opinion it is evident that they have not been properly reviewed by the FSEC or if shop drawings are submitted in an unprofessional manner, they will be returned to the FSEC for identification and/or review and re-submission. In such an event, it will be held that the FSEC has not complied with the above requirements for reviewing and identifying shop drawings and samples. The FSEC shall bear the risk of all delays in work or in work of any other trade, the same as if no shop drawing or samples had been submitted. The above requirements will be strictly enforced.

The Consultant will review and process only two (2) submissions of each shop drawing and/or sample. Shop drawings and samples returned because the FSEC has not complied with the above requirements shall be counted as the first submission. If more than two (2) submissions are required, the FSEC shall pay the Consultant's cost for reviewing and processing the third and subsequent submissions. (Which will be so identified by the Consultant when returned to the FSEC)

The Consultant's cost shall be computed at two and one half (2-1/2) times payroll plus reproduction and mailing expense.
Buy-out Booklets

By submitting prepared Buy-out Booklets, the FSEC thereby represents that he has determined and verified voltage and phase requirements and that he has checked and coordinated each item with shop drawings and contract documents.

Each item in the Buy-out booklet shall have a typed title page, complete with descriptive details and included accessories.

TITLE PAGE TO BE AS PER THE FOLLOWING PAGE.

8. EXECUTION

Inspections

The Owner, Architect, and/or their duly authorized representative shall have free access to the contractor's shop or shops during the construction of this equipment for the purpose of making inspections to see that the plans and specifications and detailed drawings are being adhered to carefully.

Contractor shall correct any errors found during the inspections, to the extent within the scope of the plans, specifications and detailed drawings.

Upon being notified of job completion, it shall be the responsibility of the Food Service Consultant to inspect the job site and prepare an itemized Punch List.

If items are found not to be complete per approved drawings, General Requirements and the Consultant's Item Specifications, upon receiving the Punch List, the FSEC shall correct all items on the list within thirty (30) days.

It shall be the responsibility of the Plumbing and Electrical Trades to check all rough-in connections installed by their personnel to make sure that they agree with the dimensioned
SAMPLE TITLE PAGE

Food Service Equipment Contractor ___________________________

ITEM # ______ QUANTITY ______

Description: _____________________________________________

Electrical

Motor H.P. ______ Volts ______ Phase ______ Cycle ______
Heating Element: KW ______ Volts ______ Phase ______
Lighting and/or Fan Circuit: ______ Volts ______ Phase ______
Refrigeration specs:

Plumbing

Cold Water ______ 140 degree water ______ 180 degree water ______
Steam in ______ Steam Pressure ______ Pounds ______
Steam Return ______ Connected Waste ______ Floor Waste ______
Gas
Kind ______ Size ______ B.T.U. ______
Spec. Gravity ______ Pressure ______

Direction of Feed for Dishwasher

Right to Left, Left to Right, Straight Thru, Corner type, Clockwise, and Counter Clockwise (circle unit required).

Door Hinged

Right Side, Left side (Circle unit required).
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2017 SINKING FUND PROJECTS  
FERNDALE HS-KITCHEN/SERVING LINE AND CAFETERIA RENOVATION  
171745  
JANUARY 12, 2018

FSEC shall verify with the Electrical Trades the voltage and phase required for each piece of equipment that is to be supplied. Should the FSEC fail to verify the voltage characteristics it shall be his responsibility for changing the equipment on the job site to fit the voltage on the site.

When deemed necessary by the Architect or the Consultant, the FSEC shall meet on the job site with the Electrical and Plumbing Trades to determine the best way of offsetting rough-in connections that interfere with beams, foundations or other possible field obstructions.

The FSEC shall check all base sizes, after installation by the Architectural Trades, to make sure that they will fit his equipment. Should base be installed incorrectly, the FSEC shall advise the Architectural Trades in writing at once to have base corrected as required.

The FSEC shall check all walls where equipment abuts or fits between, after installation by the Architectural Trades, to make sure that the equipment will fit correctly.

9. PREPARATION

All gas equipment is to be furnished with appliance pressure regulators. Electrical requirements shall be in accordance with rough-in plan and verified on the job site.

Should the electrical requirements and the item specifications not agree with the rough-in plan or electrical requirements on the job site, it shall be the responsibility of the FSEC to send a written report to the Architect and Consultant advising them of the discrepancy. Should the FSEC fail to verify voltages on the job site, it shall be his full responsibility to make all necessary changes on his equipment at no cost to the Owner.

All measurements shall be verified at the building site and full responsibility for their correctness must be assumed by the Contractor.

No extra charge or compensation will be allowed on account of difference between actual dimensions and the measurements indicated on the drawings. All or any differences which may be found shall be submitted to the Architect for consideration before proceeding with the work.
10. **INSTALLATION**

**Food Service Equipment**

FSEC shall be responsible for assembly and erection of all equipment included herein and in required location as shown on drawings, leaving same with outlets for other contractors to make final steam, plumbing, electrical and ventilation connections.

FSEC is to provide a competent foreman to supervise the erection and placing of equipment and to advise other Trades in regards to connections at time of installation. Where applicable, he shall deliver to other Trades all plumbing, steam fittings, and electrical parts included with his equipment for their proper installation.

FSEC to have qualified personnel on job site while the Plumbing, Electrical, and H.V.A.C. Trades are making final connections between rough-in and equipment. Where necessary, FSEC is to move equipment to allow these Trades to make final connections.

Should the FSEC fail to assist the other Trades and final location of equipment is incorrect, it shall be the responsibility of the FSEC to move the equipment to correct location and assume the cost of disconnecting and reconnecting the service connections.

FSEC is responsible for cutting all holes thru tops, backsplashes, shelves and cabinets so the other Trades can make final connections to outlets in fixtures from his rough-in.

Should these Trades fail to check rough-in before slab is poured, they shall assume all responsibility for making necessary changes and paying all the costs involved. Should the dimensioned rough-in drawings be incorrect, it shall be the responsibility of the FSEC to assume costs involved for revising all connections involved in the dimensioned error.

FSEC shall verify with the Electrical Trades the voltage and phase required for each piece of equipment that is to be supplied. Should the FSEC fail to verify the voltage characteristics it shall be his responsibility for changing the equipment on the job site to fit the voltage on the site.
When deemed necessary by the Architect or the Consultant, the FSEC shall meet on the job site with the Electrical and Plumbing Trades to determine the best way of offsetting rough-in connections that interfere with beams, foundations or other possible field obstructions.

Rough-in Inspections

It shall be the responsibility of the Plumbing and Electrical Trades to check all rough-in connections installed by their personnel to make sure that they agree with the dimensioned rough-in drawings as prepared by the FSEC.

Should these Trades fail to check rough-in before slab is poured, they shall assume all responsibility for making necessary changes and paying all the costs involved. Should the dimensioned rough-in drawings be incorrect, it shall be the responsibility of the FSEC to assume costs involved for revising all connections involved in the dimensioned error.

FSEC to have qualified personnel on job site while the Plumbing, Electrical, and H.V.A.C. Trades are making final connections between rough-in and equipment. Where necessary, FSEC is to move equipment to allow these Trades to make final connections. Should the FSEC fail to assist the other Trades and final location of equipment is incorrect, it shall be the responsibility of the FSEC to move the equipment to correct location and assume the cost of disconnecting and reconnecting the service connections.

FSEC is responsible for cutting all holes thru tops, backsplashes, shelves and cabinets so the other Trades can make final connections to outlets in fixtures from his rough-in.

Should specified equipment arrive at the job site with incorrect finish, model number, damaged, etc. A replacement item must be ordered immediately. Should the project schedule require the incorrect unit for opening operation, existing unit is to be left in operation until replacement is available, at no cost to the owner. It shall be the responsibility of the FSEC to assume all costs for re-stocking, re-selling, etc., of the incorrect items that have been used by the Owner.

All holes or openings must be cut in a workmanlike manner, with all edges ground and polished smooth and free of sharp edges.
Opening in rear of base cabinet must not be larger than 1" bigger than pipe extending thru cabinet. Oversize cutouts with rough edges will not be approved.

All faucets and waste assemblies to be furnished by the FSEC and to be turned over to the Plumbing Trades for their installation. NOTE! Faucets and waste assemblies to be tagged properly to insure proper installation of these items on the correct fixtures.

Ventilating Trades

This Trade will furnish all ductwork to openings on top hoods, furnished by the FSEC.

Electrical and Plumbing Trades

These Trades shall furnish all final electrical and plumbing connections between fixtures and rough-in outlets in walls or floors.

Internal connections on booster heater and disposer to be furnished by the Plumbing and Electrical Trades and proper installation of these above named items. FSEC shall also include detailed drawings showing proper location of all accessories. General Building Contractor shall furnish all masonry platforms, tile bases and floor depressions.

Trimming & Sealing Equipment

Space between units to walls, ceilings, and floors and adjoining units not portable and with enclosed bodies, shall be completely sealed against entrance of food particles or vermin by means of st. st. trim strips, welding or commercial joint material suitable to the nature of the equipment. Sealer when not exposed to extreme heat shall be silicone construction sealant in the appropriate color. Ends of hollow sections to be closed. Enclosed fixtures without legs mounted on masonry bases or floor shall be sealed watertight to base of floor.

All equipment setting on masonry bases will be constructed to overhang to provide toe spaces, however, metal framework and/or housings are to be turned under a sufficient distance to overlap masonry base and eliminate openings at these points. Bases to
be sealed with Dow Corning sealant #786 or approved G.E. sealant.

Caulking at all backsplash areas in pot washing, dishwashing and preparation sinks and counters shall not have any recessed or convex areas which will allow for debris and water to sit on caulk.

Upright penetrations in backsplash and counter tops to have gap sealed with silicone.

11. **ADJUST & CLEAN**

FSEC shall adjust and lubricate all moving parts for smooth quiet operation. The FSEC shall touch up scratches, marred or abraded surfaces to restore equipment to the original condition.

The FSEC shall also remove all crating and packing material from the job site and shall also remove fingerprints and leave equipment and adjacent equipment or surfaces clean.

The FSEC shall be responsible for missing items unless he can produce signed receipts from the Owner's personnel that the items were received and accounted for. Owner cannot be responsible for items that were dropped off at the job site and were not signed for by the Owner's personnel or representatives.

12. **DEMONSTRATION**

The FSEC shall arrange a demonstration date with the Owner and at the same time check out all loose items with the Food Service Manager. Copy of signed receipts shall be mailed to E. F. WHITNEY, INC., showing all loose items, such as st. st. pans, mixer attachments, etc.

13. **GUARANTEE**

All items furnished by the Food Service Equipment Contractor as part of this Contract, shall be guaranteed against defects in workmanship and material for a period of one (1) year.

Manufacturers of standard items of equipment as supplied under this Contract are to provide a one (1) year warranty on parts and labor.
In addition, connected pieces of equipment requiring calibration are to be so calibrated by a qualified person as part of this Contract.

Commencement date for warranty purposes is as follows:

a. Connected equipment: - When equipment is started up for intended use."

b. Non-connected equipment: - At date of Owner acceptance.”

14. **PROTECTION OF EQUIPMENT**

Fabricated fixtures such as custom st. st. & plastic laminate items are to have fiberboard or plywood taped to tops and exposed body panels. Protective covering is to be left in place until all trades are completed.

Manufactured equipment is to have fiberboard or plywood tape as required per equipment shape and installation access requirements.

Prohibited use of equipment; tool and material storage area, workbench, scaffold, stacking area, etc.

15. **APPROVED CUSTOM ST. ST. FABRICATORS**

The following is a list of fabricators who have demonstrated the ability to provide quality equipment.

Florida Stainless
Oviedo, FL

American Stainless Steel Corp
Englewood, CO.

PRS
Warren, MI

Great Lakes Stainless
Traverse City, MI

MCM Fixture Co.
Hazel Park, MI
Midwest Stainless Fabricating Co.
Livonia, MI

Nationwide Fabrication, Inc.
Northglenn, CO

Stainless Fixtures Inc.
Pomona, CA

Use of a food service equipment fabricator other than those listed must be specifically approved in writing by the consultant prior to submission of food service equipment bids on this project.
ITEM #1 HOLDING CABINET, HUMIDIFIED HEATED

One (1) FWE model #MTU-12D portable hot food cart. Units to be sized to accommodate both 12 x 20 & 18 x 26 pans and trays. Provide units with the following standard and optional accessories:

One (1) Lot Dutch Doors
One (1) Lot of locking casters
One (1) UL Approved cord and plug

ITEM #2 HOLDING CABINET, HUMIDIFIED HEATED

One (1) FWE model #MTU-12D portable hot food cart. Units to be sized to accommodate both 12 x 20 & 18 x 26 pans and trays. Provide units with the following standard and optional accessories:

One (1) Lot Dutch Doors
One (1) Lot of locking casters
One (1) UL Approved cord and plug

ITEM #3 HOT/COLD COUNTER W/ ADJ SERVED/SELF SERVE PROTECTO

QTY: One (1)

MFR./MODEL: ATLAS BLU-5-MOD

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing.

ACCESSORIES:

One (1) RMHP-5 Hot/Cold Drop in, installed in unit not centered as shown on plan.
One (1) Base floor clearance to align with adjacent units on casters
One (1) AutoFill Option
One (1) Rear Drain Extensions for Easy Reach
One (1) Lot Individual Drains with Individual shut off valves per code
Five (5) St. St. Adapter Bars
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

One (1) Five Year Compressor Warranty
One (1) TS-5, 12” Folding Tray Slide
One (1) 8” Rear st. st. work shelf
One (1) PRHC-5-ADJ Sneeze guard with heat lamp and lights
One (1) Lot of End Panels for Sneeze Guard
One (1) USB-5 Bottom Shelf
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot st. st. legs with adjustable feet
One (1) UL Cord and Plug common with drop in unit, heat lamp and
lights.
One (1) Lot Cam Locks

Submit shop drawing for approval

**ITEM #4  FLAT TOP CORNER UNIT**

QTY: One (1)

MFR./MODEL: ATLAS BL-CU-I

SPECIFICATIONS: Provide one corner mobile serving unit with
flat top. The top of the unit shall be constructed of 16 gauge
type 304 stainless steel. The frame shall be constructed of hi-
tensile square aluminum tubing. Unit shall be provided with
enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) USMB-1 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) Lot Cam Locks
One (1) Base floor clearance to align with adjacent units on
legs

Submit shop drawing for approval
ITEM #5  FLAT TOP CORNER UNIT

QTY: One (1)

MFR./MODEL: ATLAS BL-CU-I

SPECIFICATIONS: Provide one corner mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:
One (1) USMB-1 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

ITEM #6  FLAT TOP SERVING COUNTER

QTY: One (1)

MFR./MODEL: ATLAS BLU-4

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:
One (1) TS-4 12” Folding Tray Slide with mitered end
One (1) Apron Mounted Convenience Outlet 120v, single phase
One (1) UL Approved cord and plug
One (1) USMB-4 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

ITEM #7 FLAT TOP SERVING COUNTER

QTY: One (1)

MFR./MODEL: ATLAS BLU-4

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) TS-4 12” Folding Tray Slide with mitered end
One (1) Apron Mounted Convenience Outlet 120V, single phase
One (1) UL Approved cord and plug
One (1) USMB-4 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

ITEM #8 FLAT TOP SERVING COUNTER W/ SELF SERVE PROTECTO

QTY: One (1)

MFR./MODEL: ATLAS BLU-2

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) BC-2-FL
One (1) TS-2 12” Folding Tray Slide
One (1) 8” st. st. fold down work shelf
One (1) USMB-2 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) UL Cord and plug
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

**ITEM #9  COLD FOOD COUNTER W/ SELF SERVE PROTECTO**

QTY: One (1)

MFG/MODEL: ATLAS BLC-5-RM

SPECIFICATIONS: Provide one mobile serving unit with a 9” D refrigerated cold pan. The cold pan shall be constructed of 18 gauge type 304 stainless steel with a solid vinyl gasket. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. Unit shall be provided with a fully self-contained condensing unit. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:
One (1) TS-5 Folding Tray Slide
One (1) 8” St. ST. Folding work shelf
One (1) Lot of Laminate Panels (color to be determined)
One (1) BC-5 FL Self Serve Protecto with end panels & Lights
One (1) USB-5 Bottom Shelf
One (1) Lot casters w/ locks
One (1) UL Cord and plug for lights and cold pan
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit Shop Drawing for Approval

**ITEM #10  FLAT TOP SERVING COUNTER W/ SELF SERVE PROTECTO**

QTY: One (1)

MFR./MODEL: ATLAS BLU-2

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304
stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) BC-2-FL
One (1) TS-2 12” Folding Tray Slide
One (1) USMB-2 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) UL Cord and plug
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

ITEM #11 ST. ST. HAND SINK

QTY: One (1)

MFG. & MODEL: ADVANCE #7-PS-40

CONST: Sink to be constructed of Stainless Steel. Sink to be furnished with 8” backsplash with 2” return to wall and flange down.

ACCESSORIES: Furnish with strainer type 6” tailpiece and “P” trap all to be chrome plated brass. Include T&S faucet with wrist action handles.

Provide st. st. splash shield on Left and Right hand side. Soap and towel dispenser to be furnished by owner.

DETAILS: Sink to be mounted with rim 34” above finished floor with rough-in for water and waste located 4-7/8” below the 6-1/2” deep sink.

ITEM #12 COUNTER TOP BEVERAGE COOLER

One (1) Unit furnished and installed by owner. “NIC”
ITEM #13  FLAT TOP SERVING COUNTER

QTY: One (1)

MFR./MODEL: ATLAS BLU-3

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) USMB-3 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) Apron Mounted Convenience Outlet 120v, single phase
One (1) UL Cord and plug
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

ITEM #14 CASHIERS UNIT

QTY: One (1)

MFR./MODEL: ATLAS BLM-BU-L/R EXT

SPECIFICATIONS: Provide one mobile serving unit with a stainless steel key lock drawer for cashier. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

Two (2) 36” long x 12” Folding Tray Slide as shown on plan
One (1) Lot of Laminate Panels (color to be determined)
One (1) USB-1 Bottom Shelf
One (1) Convenience Outlet 120v, single phase
One (1) Lot casters w/ locks
One (1) Cash Drawer
One (1) Grommet hole in top
One (1) UL Cord and plug

Submit shop drawing for review and approval.

**ITEM #15  POS REGISTERS**

One (1) Lot furnished and installed by owner. “NIC”

**ITEM #16  NOT USED**

**ITEM #17  NOT USED**

**ITEM #18  FLAT TOP SERVING COUNTER**

QTY: One (1)

MFR./MODEL: ATLAS BLU-2

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) TS-2 12” Folding Tray Slide with mitered end
One (1) USMB-2 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined)
One (1) Apron Mounted Convenience Outlet 120v, single phase
One (1) UL Cord and plug
One (1) Lot casters w/ locks
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval
ITEM #19 ST. ST. HAND SINK

QTY: One (1)

MFG. & MODEL: ADVANCE #7-PS-40

CONSTRUCTION: Sink to be constructed of Stainless Steel. Sink to be furnished with 8” backsplash with 2” return to wall and flange down.

ACCESSORIES: Furnish with strainer type 6” tailpiece and “P” trap all to be chrome plated brass. Include T&S faucet with wrist action handles.

Provide st. st. splash shield on Left and Right hand side. Soap and towel dispenser to be furnished by owner.

DETAILS: Sink to be mounted with rim 34” above finished floor with rough-in for water and waste located 4-7/8” below the 6-1/2” deep sink.

ITEM #20 COUNTER TOP BEVERAGE COOLER

One (1) Unit furnished and installed by owner. “NIC”

ITEM #21 COLD FOOD COUNTER W/ SELF SERVE PROTECTO

QTY: One (1)

MFG/MODEL: ATLAS BLC-5-RM

SPECIFICATIONS: Provide one mobile serving unit with a 9” D refrigerated cold pan. The cold pan shall be constructed of 18 gauge type 304 stainless steel with a solid vinyl gasket. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. Unit shall be provided with a fully self-contained condensing unit. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) TS-5 Folding Tray Slide
One (1) 8” St. ST. Folding work shelf
One (1) Lot of Laminate Panels (color to be determined)
One (1) BC-5 FL Self Serve Protecto with end panels & Lights
One (1) USB-5 Bottom Shelf
One (1) Lot casters w/ locks
One (1) UL Cord and plug for lights and cold pan
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit Shop Drawing for Approval

**ITEM #22 FLAT TOP SERVING COUNTER W/ SELF SERVE PROTECTO**

**QTY:** One (1)

**MFR./MODEL:** ATLAS BLU-3

**SPECIFICATIONS:** Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5" diameter casters.

**ACCESSORIES:**

One (1) BC-3-FL
One (1) TS-3 12” Folding Tray Slide
One (1) 8” st. st. fold down work shelf
One (1) USMB-3 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) UL Cord and plug
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

**ITEM #23 HOT/COLD COUNTER W/ SELF SERVE PROTECTO**

**QTY:** One (1)

**MFR./MODEL:** ATLAS BLU-3-MOD

**SPECIFICATIONS:** Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing.
ACCESSORIES:

One (1) RMHP-3 Hot/Cold Drop in, installed in unit not centered as shown on plan.
One (1) Base floor clearance to align with adjacent units on casters
One (1) AutoFill Option
One (1) Rear Drain Extensions for Easy Reach
One (1) Lot Individual Drains with Individual shut off valves per code
Three (3) St. St. Adapter Bars
One (1) Five Year Compressor Warranty
One (1) TS-3, 12” Folding Tray Slide
One (1) 8” Rear st. st. work shelf
One (1) BC-3-FWL Buffet canopy HATCO heat and lights
One (1) Lot of End Panels for Sneeze Guard
One (1) USB-3 Bottom Shelf
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot st. st. legs with adjustable feet
One (1) UL Cord and Plug common with drop in unit, heat lamp and lights.
One (1) Lot Cam Locks

Submit shop drawing for approval

**ITEM #24 FLAT TOP SERVING COUNTER W/ SELF SERVE PROTECTO**

QTY: One (1)

MFR./MODEL: ATLAS BLU-3

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) BC-6-FWL Buffet canopy HATCO heat and lights
One (1) TS-6 12” Folding Tray Slide
One (1) 8” st. st. fold down work shelf
One (1) USMB- St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined)
One (1) Lot casters w/ locks
Two (2) Apron Mounted Convenience Outlet 120v, single phase – Verify NEMA w/ #25&26
Three (3) UL Approved cord and plugs
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

**ITEM #25 HEATED SHELF**

One (1) HATCO model #GRS-36-L counter top heated shelf furnished per manufacturers standards. Unit to sit on top of counter item #24. Unit to be furnished with the following:

One (1) UL cord and plug
One (1) Stainless top surface finish

**ITEM #26 HEATED SHELF**

One (1) HATCO model #GRS-42-L counter top heated shelf furnished per manufacturers standards. Unit to sit on top of counter item #24. Unit to be furnished with the following:

One (1) UL cord and plug
One (1) Stainless top surface finish

**ITEM #27 – 34 NOT USED**

**ITEM #35 ST. ST. HAND SINK**

QTY: One (1)

MFG. & MODEL: ADVANCE #7-PS-40

CONST: Sink to be constructed of Stainless Steel. Sink to be furnished with 8” backsplash with 2” return to wall and flange down.

ACCESSORIES: Furnish with strainer type 6” tailpiece and “P” trap all to be chrome plated brass. Include T&S faucet with wrist action handles.

Provide st. st. splash shield on Left and Right hand side. Soap and towel dispenser to be furnished by owner.
DETAILS: Sink to be mounted with rim 34” above finished floor with rough-in for water and waste located 4-7/8” below the 6-1/2” deep sink.

ITEM #36 HOLDING CABINET, HUMIDIFIED HEATED

One(1) FWE model #MTU-12D portable hot food cart. Units to be sized to accommodate both 12 x 20 & 18 x 26 pans and trays. Provide units with the following standard and optional accessories:

One (1) Lot Dutch Doors
One (1) Lot of locking casters
One (1) UL Approved cord and plug

ITEM #37 HOT/COLD COUNTER W/ ADJ SERVED/SELF SERVE PROTECTO

QTY: One (1)

MFR./MODEL: ATLAS BLU-5-MOD

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing.

ACCESSORIES:

One (1) RMHP-5 Hot/Cold Drop in, installed in unit not centered as shown on plan.
One (1) Base floor clearance to align with adjacent units on casters
One (1) AutoFill Option
One (1) Rear Drain Extensions for Easy Reach
One (1) Lot Individual Drains with Individual shut off valves per code
Five (5) St. St. Adapter Bars
One (1) Five Year Compressor Warranty
One (1) TS-5, 12” Folding Tray Slide
One (1) 8” Rear st. st. work shelf
One (1) PRHC-5-ADJ Sneeze guard with heat lamp and lights
One (1) Lot of End Panels for Sneeze Guard
One (1) USB-5 Bottom Shelf
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot st. st. legs with adjustable feet
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

One (1) UL Cord and Plug common with drop in unit, heat lamp and lights.
One (1) Lot Cam Locks

Submit shop drawing for approval.

ITEM #38  FLAT TOP SERVING COUNTER W/ SELF SERVE PROTECTO

QTY: One (1)

MFR./MODEL: ATLAS BLU-2

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:
One (1) BC-2-FL
One (1) TS-2 12” Folding Tray Slide
One (1) 8” st. st. fold down work shelf
One (1) USMB-2 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) UL Cord and plug
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

ITEM #39  COLD FOOD COUNTER W/ SELF SERVE PROTECTO

QTY: One (1)

MFG/MODEL: ATLAS BLC-5-RM

SPECIFICATIONS: Provide one mobile serving unit with a 9” D refrigerated cold pan. The cold pan shall be constructed of 18 gauge type 304 stainless steel with a solid vinyl gasket. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. Unit shall be provided with a fully self-contained condensing unit. The frame shall be constructed of
hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) TS-5 Folding Tray Slide  
One (1) 8” St. ST. Folding work shelf  
One (1) Lot of Laminate Panels (color to be determined)  
One (1) BC-5 FL Self Serve Protecto with end panels & Lights  
One (1) USB-5 Bottom Shelf  
One (1) Lot casters w/ locks  
One (1) UL Cord and plug for lights and cold pan  
One (1) Lot Cam Locks  
One (1) Base floor clearance to align with units on legs

ELECTRICAL:

Voltage and Phase per rough ins.

Submit Shop Drawing for Approval

**ITEM #40 FLAT TOP SERVING COUNTER W/ SELF SERVE PROTECTO**

QTY: One (1)

MFR./MODEL: ATLAS BLU-2

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) BC-2-FL  
One (1) TS-2 12” Folding Tray Slide  
One (1) USMB-2 St. St. middle and bottom shelves  
One (1) Lot of Laminate Panels on base (color to be determined)  
One (1) Lot casters w/ locks  
One (1) UL Cord and plug  
One (1) Lot Cam Locks  
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval
ITEM #41 COUNTER TOP BEVERAGE COOLER

One (1) Unit furnished and installed by owner. “NIC”

ITEM #42 FLAT TOP SERVING COUNTER

QTY: One (1)

MFR./MODEL: ATLAS BLU-3

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) USMB-3 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) Apron Mounted Convenience Outlet 120v, single phase
One (1) UL Cord and plug
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

ITEM #43 FLAT TOP CORNER UNIT

QTY: One (1)

MFR./MODEL: ATLAS BL-CU-I

SPECIFICATIONS: Provide one corner mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) USMB-1 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on casters
Submit shop drawing for approval

ITEM #44 FLAT TOP SERVING COUNTER

QTY: One (1)

MFR./MODEL: ATLAS BLU-4

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:
One (1) TS-4 12” Folding Tray Slide with mitered end
One (1) Apron Mounted Convenience Outlet 120v, single phase
One (1) UL Approved cord and plug
One (1) USMB-4 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs
Submit shop drawing for approval

ITEM #45 ST. ST. HAND SINK

QTY: One (1)

MFG. & MODEL: ADVANCE #7-PS-40

CONST: Sink to be constructed of Stainless Steel. Sink to be furnished with 8” backsplash with 2” return to wall and flange down.

ACCESSORIES: Furnish with strainer type 6” tailpiece and “P” trap all to be chrome plated brass. Include T&S faucet with wrist action handles.
Provide st. st. splash shield on Left and Right hand side. Soap and towel dispenser to be furnished by owner.

DETAILS: Sink to be mounted with rim 34” above finished floor with rough-in for water and waste located 4-7/8” below the 6-1/2” deep sink.

ITEM #46  ST. ST. SOILED AND CLEAN DISHTABLES

One (1) Lot of ADVANCE TABCO 14ga st. st. dishtables. Units to consist of DTS-S30-36R and DTC-30S-36L. Units to be fabricated per manufacturers standards. Include the following:

One (1) Undershelf under clean dishtable
One (1) Removable perforated st. st. scrap basket
One (1) T&S Drainer assembly
One (1) T&S Spray Assembly with built in vacuum breaker & Wall support
One (1) Punch Outs in backsplash for Spray

FSEC to seal edges to wall with clear silicone.

ITEM #47  ST. ST. WALL PANELING

One (1) Lot of Custom Fabricated 18 ga. st. st. rear and side wall paneling 30” high by length and width as shown on plan. Furnish paneling hair line butt joints. Paneling to be sealed on sides and top with clear silicone sealant.

Panel section behind dishwasher to run down to top of coved tile base. GC to provide necessary cut outs for power and water supply lines.

Submit shop drawing for review and approval.

ITEM #48  VENTLESS DISHWASHER

QTY: One (1)

MFG/MODEL:  HOBART AM-15VLT

CONST: Unit to have spring counter balanced doors arranged as shown on plan. Drawn Tank, Tank shelf and feet constructed of 16 ga. st. st. Frame to be constructed of 12 gauge st. st.
Chamber to be constructed of 18 ga. st. st. Removable trim panels to be constructed of 20 ga. st. st. NOTE! Unit to meet all state and local code for ventless operation.

ACCESSORIES:

One (1) Internal condensing system
One (1) Door Lock interlock to prevent door from being opened too soon.
One (1) Single Point electrical connection
One (1) Pressure reducing valve sized for dishwasher capacity (unconnected)
One (1) Automatic tank fill
One (1) Built in 70 degree rise electric booster heater
One (1) 5 KW Tank heater
One (1) Lot of low water tank heat protection
One (1) Splash proof pump motor
One (1) Lot of interlocked door safety switches
One (1) Lot of interchangeable spray arms
One (1) Lot of st. st. front and side panels
One (1) Lot of detergent connection provisions
One (1) Lot of NSF approved gauges on rinse & wash water
One (1) NSF Pot and Pan listed 2, 4 and 6 minute Cycle
One (1) Timed wash cycles for 1, 2, 4 or 6 minutes
One (1) 27" door opening for 18" x 26 sheet pans or 60 qt. mixing bowl
One (1) Stainless Steel Pump and Impeller
One (1) Delime notification (field activated) and Delime Cycle
One (1) Drain Water tempering kit
Two (2) Sheet Pan Rack
Two (2) Standard 20" x 20" dish racks
Two (2) Standard 20" x 20" open racks

ELECT: Per rough in drawings.

ITEM #49  ICE MAKER W/ BIN

ITEM #50  CASHIERS UNIT

QTY: One (1)

MFR./MODEL: ATLAS BLM-BU-L/R EXT
SPECIFICATIONS: Provide one mobile serving unit with a stainless steel key lock drawer for cashier. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

Two (2) 36” long x 12” Folding Tray Slide as shown on plan
One (1) Lot of Laminate Panels (color to be determined)
One (1) USB-1 Bottom Shelf
One (1) Convenience Outlet 120v, single phase
One (1) Lot casters w/ locks
One (1) Cash Drawer
One (1) Grommet hole in top
One (1) UL Cord and plug

Submit shop drawing for review and approval.

**ITEM #51  POS REGISTERS**

One (1) Lot furnished and installed by owner. “NIC”

**ITEM #52  FLAT TOP SERVING COUNTER**

QTY: One (1)

MFR./MODEL: ATLAS BLU-4

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) TS-4 12” Folding Tray Slide with mitered end
One (1) Apron Mounted Convenience Outlet 120v, single phase
One (1) UL Approved cord and plug
One (1) USMB-4 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs
Submit shop drawing for approval

**ITEM #53 FLAT TOP CORNER UNIT**

QTY: One (1)

MFR./MODEL: ATLAS BL-CU-I

SPECIFICATIONS: Provide one corner mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) USMB-1 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined)
One (1) Lot casters w/ locks
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs
Submit shop drawing for approval

**ITEM #54 FLAT TOP SERVING COUNTER**

QTY: One (1)

MFR./MODEL: ATLAS BLU-3

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) USMB-3 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined)
One (1) Lot casters w/ locks
One (1) Apron Mounted Convenience Outlet 120v, single phase
One (1) UL Cord and plug
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

ITEM #55 COUNTER TOP BEVERAGE COOLER

One (1) Unit furnished and installed by owner. “NIC”

ITEM #56 FLAT TOP SERVING COUNTER W/ SELF SERVE PROTECTO

QTY: One (1)

MFR./MODEL: ATLAS BLU-2

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:
One (1) BC-2-FL
One (1) TS-2 12” Folding Tray Slide
One (1) USMB-2 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined)
One (1) Lot casters w/ locks
One (1) UL Cord and plug
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

ITEM #57 COLD FOOD COUNTER W/ SELF SERVE PROTECTO

QTY: One (1)

MFG/MODEL: ATLAS BLC-5-RM

SPECIFICATIONS: Provide one mobile serving unit with a 9” D refrigerated cold pan. The cold pan shall be constructed of 18 gauge type 304 stainless steel with a solid vinyl gasket. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. Unit shall be provided with a fully self-
contained condensing unit. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) TS-5 Folding Tray Slide
One (1) 8” St. St. Folding work shelf
One (1) Lot of Laminate Panels (color to be determined)
One (1) BC-5 FL Self Serve Protecto with end panels & Lights
One (1) USB-5 Bottom Shelf
One (1) Lot casters w/ locks
One (1) UL Cord and plug for lights and cold pan
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

ELECTRICAL:

Voltage and Phase per rough ins.

Submit Shop Drawing for Approval

**ITEM #58 FLAT TOP SERVING COUNTER W/ SELF SERVE PROTECTO**

QTY: One (1)

MFR./MODEL: ATLAS BLU-2

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) BC-2-FL
One (1) TS-2 12” Folding Tray Slide
One (1) 8” st. st. fold down work shelf
One (1) USMB-2 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined)
One (1) Lot casters w/ locks
One (1) UL Cord and plug
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

**ITEM #59 HOT/COLD COUNTER W/ ADJ SERVED/SELF SERVE PROTECTO**

QTY: One (1)

MFR./MODEL: ATLAS BLU-5-MOD

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing.

ACCESSORIES:

- One (1) RMHP-5 Hot/Cold Drop in, installed in unit not centered as shown on plan.
- One (1) Base floor clearance to align with adjacent units on casters
- One (1) AutoFill Option
- One (1) Rear Drain Extensions for Easy Reach
- One (1) Lot Individual Drains with Individual shut off valves per code
- Five (5) St. St. Adapter Bars
- One (1) Five Year Compressor Warranty
- One (1) TS-5, 12” Folding Tray Slide
- One (1) 8” Rear st. st. work shelf
- One (1) PRHC-5-ADJ Sneeze guard with heat lamp and lights
- One (1) Lot of End Panels for Sneeze Guard
- One (1) USB-5 Bottom Shelf
- One (1) Lot of Laminate Panels on base (color to be determined
- One (1) Lot st. st. legs with adjustable feet
- One (1) UL Cord and Plug common with drop in unit, heat lamp and lights.
- One (1) Lot Cam Locks

Submit shop drawing for approval.

**ITEM #60 HOLDING CABINET, HUMIDIFIED HEATED**

One(1) FWE model #MTU-12D portable hot food cart. Units to be sized to accommodate both 12 x 20 & 18 x 26 pans and trays.
Provide units with the following standard and optional accessories:

One (1) Lot Dutch Doors
One (1) Lot of locking casters
One (1) UL Approved cord and plug

**ITEM #61 ST. ST. HAND SINK**

QTY: One (1)

MFG. & MODEL: ADVANCE #7-PS-40

CONST: Sink to be constructed of Stainless Steel. Sink to be furnished with 8” backsplash with 2” return to wall and flange down.

ACCESSORIES: Furnish with strainer type 6” tailpiece and “P” trap all to be chrome plated brass. Include T&S faucet with wrist action handles.

Provide st. st. splash shield on Left and Right hand side. Soap and towel dispenser to be furnished by owner.

DETAILS: Sink to be mounted with rim 34” above finished floor with rough-in for water and waste located 4-7/8” below the 6-1/2” deep sink.

**ITEM #62 EXISTING ST. ST. TABLE**

One (1) Existing unit to be cut down or relocated to accommodate new dishwasher area. FSEC to field verify existing conditions. If counter is cut down, edge to be finished back to match original finish.

**ITEM #63 ST. ST. HAND SINK**

QTY: One (1)

MFG. & MODEL: ADVANCE #7-PS-40

CONST: Sink to be constructed of Stainless Steel. Sink to be furnished with 8” backsplash with 2” return to wall and flange down.
ACCESSORIES: Furnish with strainer type 6” tailpiece and “P” trap all to be chrome plated brass. Include T&S faucet with wrist action handles.

Provide st. st. splash shield on Left and Right hand side. Soap and towel dispenser to be furnished by owner.

DETAILS: Sink to be mounted with rim 34” above finished floor with rough-in for water and waste located 4-7/8” below the 6-1/2” deep sink.

ITEM #64 HOT/COLD COUNTER W/ ADJ SERVED/SELF SERVE PROTECTO

QTY: One (1)

MFR./MODEL: ATLAS BLU-4-MOD

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing.

ACCESSORIES:
One (1) RMHP-3 Hot/Cold Drop in, installed in unit not centered as shown on plan.
One (1) Base floor clearance to align with adjacent units on casters
One (1) AutoFill Option
One (1) Rear Drain Extensions for Easy Reach
One (1) Lot Individual Drains with Individual shut off valves per code
Three (3) St. St. Adapter Bars
One (1) Five Year Compressor Warranty
One (1) TS-4, 12” Folding Tray Slide
One (1) 8” Rear st. st. work shelf
One (1) PRHC-4-ADJ Sneeze guard with heat lamp and lights
One (1) Lot of End Panels for Sneeze Guard
One (1) USB-4 Bottom Shelf
One (1) Lot of Laminate Panels on base (color to be determined)
One (1) Lot st. st. legs with adjustable feet
One (1) UL Cord and Plug common with drop in unit, heat lamp and lights.
One (1) Lot Cam Locks
Submit shop drawing for approval.

**ITEM #65 FLAT TOP SERVING COUNTER**

**QTY**: One (1)

**MFR./MODEL**: ATLAS BLU-4

**SPECIFICATIONS**: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

**ACCESSORIES**:

- One (1) USMB-4 St. St. middle and bottom shelves
- One (1) TS-4, 12” Folding Tray Slide
- One (1) 8” Rear st. st. work shelf
- One (1) PRCL-4-ADJ Sneeze guard with lights
- One (1) Lot of End Panels for Sneeze Guard
- One (1) Lot of Laminate Panels on base (color to be determined
- One (1) Lot casters w/ locks
- Two (2) Apron Mounted Convenience Outlet 120v, single phase
- Three (3) UL Cord and plug
- One (1) Lot Cam Locks
- One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

**ITEM #66 FUTURE INDUCTION WARMERS**

Two (2) Units furnished by owner at a later date.

**ITEM #67 HOT/COLD COUNTER W/ ADJ SERVED/SELF SERVE PROTECTO**

**QTY**: One (1)

**MFR./MODEL**: ATLAS BLU-3-MOD

**SPECIFICATIONS**: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing.
ACCESSORIES:

One (1) RMHP-2 Hot/Cold Drop in, installed in unit not centered as shown on plan.
One (1) Base floor clearance to align with adjacent units on casters
One (1) AutoFill Option
One (1) Rear Drain Extensions for Easy Reach
One (1) Lot Individual Drains with Individual shut off valves per code
Two (2) St. St. Adapter Bars
One (1) Five Year Compressor Warranty
One (1) TS-3, 12” Folding Tray Slide
One (1) 8” Rear st. st. work shelf
One (1) PRHC-3-ADJ Sneeze guard with heat lamp and lights
One (1) Lot of End Panels for Sneeze Guard
One (1) USB-3 Bottom Shelf
One (1) Lot of Laminate Panels on base (color to be determined)
One (1) Lot st. st. legs with adjustable feet
One (1) UL Cord and Plug common with drop in unit, heat lamp and lights.
One (1) Lot Cam Locks

Submit shop drawing for approval.

ITEM #68 COUNTER TOP BEVERAGE COOLER

One (1) Unit furnished and installed by owner. “NIC”

ITEM #69 FLAT TOP SERVING COUNTER

QTY: One (1)

MFR./MODEL: ATLAS BLU-4

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) TS-4, 12” Folding Tray Slide
One (1) USMB-4 St. St. middle and bottom shelves
One (1) Lot of Laminate Panels on base (color to be determined
One (1) Lot casters w/ locks
One (1) Apron Mounted Convenience Outlet 120v, single phase
One (1) UL Cord and plug
One (1) Lot Cam Locks
One (1) Base floor clearance to align with units on legs.

Submit shop drawing for approval

**ITEM #70 FLAT TOP CASHIER COUNTER**

QTY: One (1)

MFR./MODEL: ATLAS BLU-1

SPECIFICATIONS: Provide one mobile serving unit with flat top. The top of the unit shall be constructed of 16 gauge type 304 stainless steel. The frame shall be constructed of hi-tensile square aluminum tubing. Unit shall be provided with enclosed base and 5” diameter casters.

ACCESSORIES:

One (1) TS-1 12” Folding Tray Slide
One (1) Lot of Laminate Panels on base (color to be determined
One (1) USB-1 Bottom Shelf
One (1) Convenience Outlet 120v, single phase
One (1) Lot casters w/ locks
One (1) Cash Drawer
One (1) Grommet hole in top
One (1) UL Cord and plug
One (1) Base floor clearance to align with units on legs

Submit shop drawing for approval

**ITEM #71 POS REGISTERS**

One (1) Lot furnished and installed by owner. “NIC”

**ITEM # 72 FIELD ERECTION LABOR**

FSEC shall deliver, unload, uncrate, and install all items herein specified ready for final plumbing, electrical and
ventilation connections furnished by respective trades as outlined in the General Requirements.

All equipment shall be cleaned and polished before demonstrating equipment to the Owner. All crating and packing material to be removed from job site.

FSEC shall arrange demonstration date with Owner and at the same time check out all loose items with the Food Service Manager.

FSEC shall be responsible for missing items unless he can produce signed receipts from Owner's personnel that the items were received and accounted for. Owner cannot be responsible for items delivered to the job site that were dropped off without being signed for by Owner's personnel or representatives.

Rough-in plans to be submitted at a scale of 1/4" = 1'-0". When present equipment is re-used at new locations, it shall be the FSEC'S responsibility to show necessary rough-in requirements for these items. (See General Requirements for complete details relating to submission of shop drawings). Two (2) Buyout Books to be sent to EFW for review and approval. Additional copies for use in field etc., to be made up as required after being check by EFW.

Two (2) complete sets of all final shop drawings, instructions, and parts lists are to be turned over to the Owner secured in a binder. This booklet shall include the telephone number and address of the service company for each piece of equipment.

NOTE! FSEC shall pay all sales, consumer, use and other similar taxes for the work or portions thereof provided by the Contractor which are legally enacted at the time bids are received, whether or not yet effective.

Final payment cannot be recommended until all of the above items have been completed to our satisfaction.

** ALTERNATES **

FSA 1 – Omit standard ATLAS “BC” and “PR-ADJ” protectos and provide AT10A series units with LED lights and HATCO warmers in same configuration as originally specified.
FSA-2 – Omit all standard ATLAS modular counters and provide five (5) D&D Millwork custom fabricated serving counters and two (2) custom fabricated cashiers counters in same configuration. Cold pan drop in’s to be RM series. Hot/Cold Pans to be RM-HP series.

Counter construction to be as follows:

**SERVING COUNTERS**

Tops to be fabricated of ¾” exterior grade plywood with covered with 14 ga. st. st. #4 finish on top. Top to be turned down on front and rear 2”.

Plywood to be A-B or better exterior "Douglas Fir" with agency grade stamp certifying compliance with U.S. products standard PS-1-74.

**TRAY SLIDES**

One (1) Lot 12" wide x length shown on plan furnished in solid surface material. Material and color to be determined by architect at later date.

Tray slide to have front edge dropped 2-1/2" with bullnose. Top surface furnished with 3/4" inside integral radius running full length of counter fitting under counter top. FSEC to verify edge details with architect.

Vertical outside corners to be furnished with 1" radius with self edges applied with hot press method. Bottom of tray slide to be sealed with laminate.

**DROP IN’S**

Provide cut out in top to accommodate drop in equipment. All drop in’s to be shipped to counter manufacturer for inshop installation and wiring. Provide st. st. or laminate louvers in face of counter for air circulation as required.

**PROTECTO’S**

Provide VERSA GUARD model VG2 convertible/adjustable and VG7C Fixed self serve counter top mounted sneeze guards furnished per
manufacturers standards. Sneeze guards to have same arrangement of heat/light or led light only as original ATLAS configuration.

**CABINET BASE**

Cabinet base to be constructed of 3/4" thick exterior grade plywood covered with plastic laminate. Base to be furnished with reinforcing blocks per HD construction standards. Include flush mounted hinged doors per elevation detail and include narrow design type louvers all compressor areas to insure sufficient air circulation in cabinet base.

**SUB BASE**

Cabinet to be mounted on a 6 " high base. Base to be constructed of waterproof plywood and covered with tile by General Contractor. Verify color at a later date.

**DUPLEX OUTLETS**

Under top Furnish and install one (1) lot of duplex outlets in face of cabinet for counter equipment. Plugs are to be pre-wired to "J" boxes as shown on electrical plan. FSEC to provide grommet holes in top for cord and plugs.

**INTEGRAL BACKSPLASH**

Per plan furnish 6" high x ½" deep integral backsplash at wall areas.

Submit shop drawing for approval. Shop drawing to be coordinated with protecto drawings to assure proper upright installation.

**CASHIERS COUNTERS**

Double service portable Cashier Stands sized per plan. General Construction to be same as serving counters

Under top furnish knee space lined w/laminate panels. Furnish 1" dia. st. st. foot rest and bottom shelf covered with 20 ga. st. st.
Include 3" deep locked cash drawer with roller bearing glides for each unit. Cabinet base to extend out under tray extension area as shown on elevation detail.

Each Cashiers Stand to be furnished with two (2) T & S #B-1500 chrome plated receptacles furnished with one (1) HUBBEL #5261 single outlet grounded receptacle. Each counter to be wired with one (2) circuit for cash register and one (1) circuit for scale wired to "J" box in base of stand. "J" box to be wired to cord & plug sized to fit floor receptacle.

Mount cabinet on 6-1/2" high waterproof wood base w/plastic laminate kickplate. Behind kickplate furnish hidden casters with locks. Furnish access to casters thru knee space. Hold kickplate ½" above floor. Kickplate to have hinged section to allow unit to roll over floor mounted electrical receptacles.

Submit shop drawings for approval.
ITEMIZED PROPOSAL FORM
FERNDALE HIGH SCHOOL
FERNDALE, MICHIGAN

NAME OF BIDDER:___________________________________________________
ADDRESS:________________________________________________________________
DATE:_________________________ TELEPHONE NO_______________________

BASE BID

If this Proposal is accepted in writing within thirty (30) days from the date of the bid opening, undersigned having familiarized themselves with the drawings and specifications as prepared by E. F. WHITNEY, INC., agrees to enter into a Contract for furnishing all labor, materials, and facilities for Food Service Equipment in connection with the above named project for the total base bid sum amount of $_________________ including sales tax.

($______________________________________________________DOLLARS)

The amount shown shall be shown both words and figures. In case of a discrepancy, the amount shown in words shall govern. Sales tax amount must be shown.

TIME OF COMPLETION

The Bidder agrees to complete the above-named project in_________ consecutive calendar days.

BID GUARANTEE

TYPE:_______________________________________________________________

AMOUNT $______________________________________________________

FOOD SERVICE EQUIPMENT

11400 - 62
CONTRACT ASSUMPTIONS

The Bidder agrees to enter into a sub-contract with the General Construction Work Contractor, (Architectural Trades) as designated by the Owner. The sub-contract shall be based upon the prices, terms, and conditions set forth in the Proposal.

ADDENDA

Proposal is based on the following Addenda:

Addendum #__________ Dated:__________
Addendum #__________ Dated:__________
Addendum #__________ Dated:__________

SIGNATURE

Signed By:____________________________
Dated and signed at:________________________
State of________________this___day of______________, 2018

LEGAL STATUS OF BIDDER

A Corporation duly organized and doing business under the laws of the State of____________for whom____________________________ whose signature is affixed to this Proposal is duly authorized to execute contracts.

A Partnership, all members:
____________________________________
____________________________________
____________________________________

FOOD SERVICE EQUIPMENT 11400 - 63
INSTRUCTIONS

The Base Bid must be on fixtures specified for a fair comparison of all the bids. Prices on alternate equipment will be accepted on a separate sheet made up by the Bidder with illustrations and alternate specifications.

The following pages contain a schedule of the various items of equipment. All manufacturers' names and other data requested must be filled in by the Bidder.

ON FABRICATED ITEMS, PLEASE GIVE THE NAME OF YOUR FABRICATOR

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>DESCRIPTION</th>
<th>MANUFACTURER'S OR FABRICATOR'S NAME AND MODEL NUMBER</th>
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FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 12, 2018

9 Cold Food Counter _____ ______________________ __________
10 Flat Top Serving Counter_____ ______________________ __________
11 St. St. Hand Sink _____ ______________________ __________
12 Counter Top Cooler _____ By Owner "NIC"
13 Flat Top Serving Counter_____ ______________________ __________
14 Cashiers Unit _____ ______________________ __________
15 POS Registers _____ By Owner "NIC"
16 Not Used
17 Not Used
18 Flat Top Serving Counter_____ ______________________ __________
19 St. St. Hand Sink _____ ______________________ __________
20 Counter Top Cooler _____ By Owner "NIC"
21 Cold Food Counter _____ ______________________ __________
22 Flat Top Serving Counter_____ ______________________ __________
23 Hot/Cold Counter _____ ______________________ __________
24 Flat Top Serving Counter_____ ______________________ __________
25 Heated Shelf _____ ______________________ __________
26 Heated Shelf _____ ______________________ __________
27 - 34 Not Used
35 St. St. Hand Sink _____ ______________________ __________
36 Portable Warmer _____ ______________________ __________
37 Hot/Cold Counter _____ ______________________ __________
38 Flat Top Serving Counter_____ ______________________ __________
39 Cold Food Counter _____ ______________________ __________

FOOD SERVICE EQUIPMENT 11400 - 65
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FOOD SERVICE EQUIPMENT
## Project Details

**FERNDALE PUBLIC SCHOOLS**  
**2017 SINKING FUND PROJECTS**  
**FERNDALE HS-KITCHEN/SERVING LINE AND CAFETERIA RENOVATION**  
**PROJECT NUMBER: 171745**  
**DATE: JANUARY 12, 2018**

### Equipment Items

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<td>Field Erection Labor</td>
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<th>Description</th>
<th>By</th>
<th>Notes</th>
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</thead>
</table>

### Additional Costs

- **6% Sales Tax**

### Total Bid Amount

**TOTAL BASE BID AMOUNT**

### Alternates

**** ALTERNATES **

Amounts to be shown as complete ADD w/ Tax and installation included

- **FSA 1**  
  $ ____________  Sneeze Guard Upgrade

- **FSA 2**  
  $ ____________  Custom Counters in lieu of Standard Modular Counters

---

**FOOD SERVICE EQUIPMENT**  
**11400 - 67**
PART 1 - GENERAL

1.01 General Provisions
   A. Attention is directed to Division 0, Bidding and Contract Requirements and to Division 1 General Requirements which are hereby made a part of this Specification. Refer to other sections, divisions, and schedules for work in connection with this section.

1.02 Intent
   A. The intent of this specification is to establish minimum performance and quality criteria consistent with preestablished standards of design and function. Casework not meeting these minimum requirements will be unacceptable.

   B. The casework contractor shall be held in strict compliance with any specific materials, finishes, construction details and hardware that are specified herein. Bids proposing to supply casework not meeting these requirements will be rejected.

1.03 Work Included
   A. Furnish, deliver, and install to Owner's and Architect's satisfaction, all prefabricated plastic laminate casework as shown on drawings, schedules and equipment lists.

   B. Furnish and install all fillers, scribes, finished ends, finished backs, work surfaces/backsplashes, and cutouts required to provide a complete and finished project. Plastic laminate work surfaces shall include backer sheet.

   C. Provide sinks and fittings, electrical outlets and fixtures when specifically stated as being part of this contract.

   D. Provide locks on all tall storage, wardrobe cabinets and at all low cabinets, and upper wall cabinets unless noted otherwise. All cabinets are to be keyed alike per room. All locks are to be masterkeyable to room doors.
E. Installation, connection, and testing of all sinks, fittings, electrical fixtures; providing all rough-ins: mechanical piping, electrical runs, and connections required for a complete project.

F. Blocking, framing, and reinforcement in walls, ceilings, and floors for anchoring of cabinets and trim.

1.05 QUALIFICATIONS

A. Plastic laminate casework shall be as manufactured by Stevens Cabinet Co. Division of Stevens Industries Inc., Teutopolis, Illinois. Products and catalog numbers are from Stevens catalog and are used as basis for identification, configuration, size and quality.

B. Other pre-approved manufacturers are as follows:
   - TMI System Design Corp. Dickinson, North Dakota
   - Case Systems Inc., Midland, Michigan
   - LSI Corporation of America, Inc., Minneapolis, Minnesota
   - Polyvision Corporation, www.polyvision.com, Suwanee, Georgia
   - Fisher Hamilton, Two Rivers, Wisconsin
   - Wood Metal Casework
   - Mica-Tec, Inc.

C. Casework of other manufacturers will be considered for approval providing written request is received at least ten (10) days prior to announced bid date and approved by addendum. Bidder shall state in writing any deviations from requirements and specifications. The casework shall conform to configuration, arrangement, design, material quality, joinery, panel thickness, and surfacing of that specified and shown on drawings.

D. Manufacturers requesting approval shall submit samples with Cut-A-Ways showing cabinet construction, joinery, drawer and door construction, hardware, and materials; along with catalogs and specification in order that accurate evaluations can be made. Samples may be impounded for the duration of contract to insure construction specification compliance.

1.06 SUBMITTALS
A. Shop drawings shall be submitted for approval within thirty (30) days after formal notification of award of contract. Drawings shall consist of floor plans indicating arrangement and relation to electrical, data technology and adjacent work and equipment, and complete elevations of casework. Centerline of service requirements shall be noted for use by other trades. A schedule of all sinks, fittings, and accessories that are part of this contract shall be provided.

B. Color samples shall be submitted for selection and coordination at time of contract award. Samples of actual material and color shall be available as required.

C. Additional catalog cuts, details and samples as requested by Architect for evaluation and coordination.

D. Physical sample must be approved prior to fabrication.

1.07 PRODUCT DELIVERY AND STORAGE

A. Protect cabinet and countertops during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Store cabinets and countertops at project site installation and storage areas with similar ambient conditions as final installation. Storage areas must be kept dry, heated with low relative humidity and away from construction work such as painting, wet work, grinding and similar operations.

1.08 WARRANTY

A. Casework manufacturer shall provide lifetime guarantee and limited warranty to the original Owner against defective material and fabrication for as long as they own the product - this is a warranty of replacement and repair only, the manufacturer will correct defects in material and/or fabrication without additional cost.

B. Accessory equipment (sinks, fittings etc.) shall be warranted by appropriate manufacturer's guarantee.

PART 2 - PRODUCTS
2.01 CORE MATERIAL

A. Cabinet components having particle board core material shall be of a minimum 45 lb. density, M-2 industrial grade. The particle board used shall have been tested under ANSI A208.1 1993 standards and/or ASTMD 1037-91A.

B. Medium density fiberboard (MDF) shall be used in high stress areas as drawer members and shall be minimum 48 lb. density MD-21 grade and tested under ANSI A208.2 1994 Standards.

C. Industrial hardboard shall be pre-finished 1/4" thickness composed of wood fibers, phenolic resin binders and moisture inhibitors that meet or exceed the hardboard product standard ANSI/AHA A135.4 1988.

D. All countertops located with 3'-0'' of any direction of built-in sink and/or bubblers shall be constructed of marine grade “Greenboard” MR moisture/water resistant particle board. The particle board shall be tested under ANSI A208.1 1-1993, M3 standards.

2.02 SURFACE MATERIAL

A. Exposed exteriors shall be permanently thermofused melamine laminate, fused to core using a minimum average pressure of 320 PSI and average 320 degree F. temperature. Thermofused melamine laminate shall meet ALA 1996 specification standards, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards. (Warranted for life against delamination).

B. Exposed doors and drawer fronts shall be permanently thermofused melamine laminate, fused to core using a minimum average pressure of 320 PSI and average 320 degree F. temperature. Thermofused melamine laminate shall meet ALA 1996 specification standards, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards, (Warranted for life against delamination).

C. Exposed interiors shall be permanently thermofused
melamine laminate, fused to core using a minimum average pressure of 320 PSI and average 320 degree F. temperature. Thermodfused melamine laminate shall meet ALA 1996 specification standards, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards. (Warranted for life against delamination).

D. Semi-exposed and concealed surfaces shall be permanently thermodfused melamine laminate or high pressure decorative plastic laminate cabinet liner, 0.020" thickness for balanced construction. Thermodfused melamine laminate shall meet the ALA 1996 specifications standard, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards.

2.03 EDGINGS

A. Exposed exterior cabinet front edges shall be banded with a contrasting or matching rigid PVC extrusion, 0.020" thickness, resistant to chip, crack and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. The 0.020" thick edging shall be applied with waterproof hot melt adhesive.

B. Door and drawer front edges shall be banded with a contrasting or matching rigid PVC extrusion, 3mm (1/8") thickness, resistant to chip, crack, and high impact. Edging shall have a satin finish with UV cured top coat for additional durability. The 3mm thick edging shall be applied with waterproof hot melt adhesive, and shaped to provide radiused edges and radiused corners.

C. Adjustable shelves shall be banded with PVC extrusion, resistant to chip, crack, and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. Edging shall be applied with waterproof hot melt adhesive. Shelves to be 1" thick. 0.020" thick PVC edging shall be applied to four (4) edges of adjustable shelf.

D. All other interior components, including drawers, shall be banded with a PVC extrusion, 0.020" in thickness, resistant to chip, crack, and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. Edging to be machine applied with waterproof hot melt adhesive.

2.04 COLOR SELECTIONS
A. Exposed cabinet exteriors shall be chosen from Thermofused melamine laminate selections as depicted in manufacturer's color selector guide. A minimum of seventy (70) colors and patterns shall be available as standard selection.

B. Exposed doors and drawer fronts shall be chosen from Thermofused melamine laminate selections as depicted in manufacturer's color selector guide. A minimum of seventy (70) colors and patterns shall be available as standard selection.

C. Semi-exposed surfaces, including drawer box components, shall be finished in either pearl or grey as selected from casework manufacturer's standard interior color selections.

D. Exposed interior components, including both faces of shelves and interior face of backs to match exposed cabinet exterior color selection.

E. Door and drawer front edges shall be chosen from one of twenty-two (22) trim group colors in 3mm thick PVC in contrasting or matching colors as depicted in manufacturer's color guide.

F. Exposed front edge of cabinet, including exposed interior edges, shall be selected from one of seventy (70) trim group colors in 0.020" thick PVC in contrasting or matching colors as depicted in manufacturer's color guide, or commercial match to selected exposed exterior color based on availability.

G. Semi-exposed edges of cabinet components including drawers, shall be either pearl or grey n 0.020" thick PVC.

H. Pulls shall be available in chrome, brass, bent wire and injection molded pulls in either bent wire or contour design, to be available in twenty (20) colors as selected from manufacturer's color selector.

I. Casework of substitute brands with lesser amounts or more restrictive selection requirements will not be considered equal and shall be rejected.

J. Finishes to be laminate manufacturer's matte, suede, or
equivalent finish as approved by Architect. Samples will be reviewed by Architect for color, texture, and pattern only.

2.05 HARDWARE

A. Hinges

1. Institutional five-knuckle secured with minimum of eight screws. Hinge plate must extend into cabinet a minimum of 2 1/4" (56 mm) in order to assure maximum strength. Finish to be powder-coated baked on black enamel or brushed chrome US26D.

   a. Two hinges used on all doors less than 48" (1220 mm) in height, three hinges used on all doors 48" (1220 mm) or greater in height. Hinge to accommodate 13/16" (21 mm) door.

B. Door catches shall be a heavy-duty spring loaded, large diameter (17.5mm - 11/16") roller type catch mounted at bottom edge. All doors over 48" in height shall be provided with roller catch at both top and bottom of door.

C. Catch strike plate shall be injection molded ABS, with an integrally molded engagement ridge. Strike plate shall also provide a wide face bumper insuring a positive door stop.

D. Pulls shall be impact resistant injection molded bent wire, 4" length available per color selection in Article 2.04.H.

E. Drawer and slide out shelves shall be suspended with bottom mount, side and bottom attached nylon roller epoxy coated steel slides to ensure quiet, smooth operation. Lateral stability is achieved thru a special formed captive profile. Slides shall have 100 lb. load rating, with both in and out drawer stop, 3" self close feature and a side adjustment cam allowing 3mm side to side alignment.

F. Drawers specifically noted for full extension file use shall be suspended with bottom mount, side and bottom attached nylon roller epoxy coated steel slides to ensure quiet, smooth operation. Lateral stability is achieved thru a special formed captive profile. Slides shall have 150 lb. load rating, with both in and out drawer stop, and
3" self close feature. File drawer shall include extruded top mounted molded side rails to accept standard hanging file folders.

G. Knee-space, pencil drawers, and keyboard trays, shall be designed to permit under counter or support frame mounting, with 100 lb. nylon roller epoxy coated steel slides.

H. Hanger rods shall be heavy chrome plated tubing. Rod shall be securely affixed to cabinet shelves.

I. Tote trays shall be of high impact polystyrene with smooth edges. Each tray to include an identification card holder and shall be suspended from rails securely attached to cabinet verticals.

J. Shelf support clips for 1" thick adjustable shelves shall be injection molded clear polycarbonate. Support clips shall incorporate integral molded lock tabs to retain shelf from topping or inadvertently being lifted out. Support clip shall have 5mm dia. double pin engagement into precision bored hole pattern in cabinet vertical members. Clips shall have a molded ridge which provide pressure against edge of shelving to maintain positive pin engagement. Clip shall be designed in such a manner to provide means for permanent retention to shelf. Static test load must exceed 200lb. per clip.

K. Dividers that are 1/4" thick shall be fully adjustable and retained with injection molded clear polycarbonate clip.

L. Locks shall be cylinder type, diecast, with five (5) disc tumbler mechanism. Each lock shall be provided with milled brass key. Master key cabinets to room doors. Cabinets with multiple locks installed shall be keyed alike by room, with each cabinet in that room keyed the same unless otherwise specified. Locks shall be Remov-A-Core to give flexibility for different pass key options. Locks shall be provided on all cabinets capable of locking. Key all cabs and drawers within each room alike. Each room to be keyed differently. Provide 1 Master key for all locks. Note: Key each cabinet and drawer in Staff Lounge 152 differently with 1 Master key.

M. Sliding door track shall be double channel rigid PVC
extrusion at both top and bottom of doors. Track shall be available in pearl, black or grey colors.

2.06 COMPONENTS

A. Base, wall and tall cabinet ends shall be 3/4" thick particle board, laminated for balanced construction, surfaced as described in Article 2.02.A and edged as described in Article 2.03.A.

B. Base and tall cabinet tops and bottoms shall be 3/4" thick particle board, laminated for balanced construction, surfaced as described in Article 2.02.C, and edged as described in Article 2.03.A.

C. Wall cabinet top and bottom shall be 1" thick particle board, laminated for balanced construction, surfaced as described in Article 2.02.C, and edged as described in Article 2.03.A.

D. Vertical cabinet members shall be 3/4" thick particle board, laminated for balanced construction, surfaced as described in Article 2.02.C, and edged as described in Article 2.03D.

E. Cabinet backs shall be 1/4" thick pre-finished industrial hardboard.

F. Frame rails shall be 3/4" thick x 3 3/4" wide particle board, laminated for balanced construction, surfaced as described in Article 2.02.C, and edged as described in Article 2.03.A.

G. Sub base shall consist of two (2) toe kick support rails shall be 3/4" thick x 3 3/4" high particle board and be inset from cabinet front and back edge, to give additional load support.

H. Mounting rails shall be 3/4" thick x 3 3/4" wide particle board. Wall cabinets shall have rails positioned at the top and bottom. Tall cabinets shall have rails positioned at the top and intermediate location. Base cabinet shall have rails positioned at the top of unit.

I. Drawers shall be full box design with a separate front.
Drawer sides and ends shall be constructed of 5/8" medium density fiberboard with pearl or grey color thermofused melamine laminate and matching PVC top edges. Bottoms shall be 1/4" thick medium density fiberboard, pearl or grey color thermofused melamine laminate.

J. Adjustable shelves shall be 1" thick. Edges of shelf shall be banded as described in Article 2.03.C with a high impact, rigid PVC extrusion, pearl or grey in color.

K. Sliding display doors shall be constructed of 1/4" thick distortion free glazing sheet. Center edge shall be capped with full length aluminum channel. Aluminum channel shall be custom extruded, clear etched and anodized. Full length extruded aluminum channel shall be used on other edges.

L. Solid hinged doors, sliding doors and drawer fronts shall be 3/4" thick material of balanced construction, surfaced as described in Section 2.02.B, edged as described in Article 2.03.B.

2.07 CONSTRUCTION

A. Cabinet parts shall be accurately machined and precision bored for premium grade quality joinery construction, utilizing automatic machinery to ensure consistent sizing on modular cabinets. Cabinets shall be assembled under controlled case clamp conditions, assuring final cabinet squareness and proper joint compressions.

B. Cabinet ends shall be bored to receive 8mm, industrial grade hardwood laterally fluted dowels with chamfered ends. Cabinet ends shall be prepared to receive adjustable shelf hardware at 32mm (approximately 1 1/4") centers. Door hinges and drawer slides shall be machined drilled to maintain vertical and horizontal alignment of components. Inset grooving with chamfer shall be machined 3/4" from rear edge to accept the 1/4" back. Base and tall units shall have one piece end panels continuous to floor for added load capabilities.

C. Tops and bottoms shall be joined to cabinet ends using a minimum of six (6) dowels at each joint for twenty-four (24) inch deep cabinets and a minimum of four (4) dowels at each joint, for twelve (12) inch deep cabinets. All dowels to be industrial grade hardwood, laterally fluted, with chamfered ends and 8mm in diameter. Top of base
cabinet will be full depth. Inset grooving with chamfer shall be machined 3/4" from rear edge to accept the 1/4" back.

D. Vertical dividers shall be bored to receive adjustable shelf hardware at 32 mm (approximately 1 1/4") centers. Dividers shall be joined to tops and bottoms with 8mm diameter hardwood dowels.

E. Frame rails shall be joined to ends with 8mm diameter hardwood dowels.

F. Two (2) toe kick supports shall be inset from cabinet front and back edges, and doweled into cabinet ends with 8mm hardwood dowels.

G. Mounting rails shall be fully concealed behind backs. Rails shall be 3/4" thick and fastened to cabinet ends with 8mm hardwood dowels. Wall and tall cabinet shall incorporate two mounting rails. Wall cabinets shall have rails positioned at top and bottom. Tall cabinets shall have rails positioned at top and intermediate location. Base units shall have rail positioned in the upper back area.

H. Back panels shall be 1/4" thick and inset 3/4" from rear edge of cabinet. Back shall be glued and continuously trapped in top, bottom and ends of cabinets.

I. Drawer corner joints shall be interlocking dowel pin design. Hardwood dowel pins, 8mm diameter shall be inserted into drawer fronts and backs to fit into machined hole patterns in drawer sides. Bottoms shall be trapped into grooves on all four sides glued and mechanical fastened. Drawers shall be suspended on slides as described in Article 2.05.E.

2.08 WORK SURFACES

A. Core material having particle board shall be of a minimum 45 lb. density, M-2 industrial grade. The particle board used shall have been tested under ANSI A208.1 1993 standards and/or ASTMD 1037-91A.

B. Surface material shall be high pressure decorative plastic laminate thermoset to core using catalyzed PVA glue with a minimum average pressure of 90 PSI and average 180 degree F temperature. High pressure decorative plastic laminate shall meet NEMA LD 3-1995, HGP.039 specification standards.

C. Color selection shall be high pressure decorative plastic
laminate selections as depicted in manufacturer's color selector guide. A minimum of seventy (70) colors and patterns shall be available as standard selection.

D. Exposed edges shall be 90 degree plastic laminate with a chamfered edge.

E. Underside of all work surfaces to have BK-20 backer or approved equivalent. This balance sheet shall be thermoset to core using catalyzed PVA glue with a minimum average pressure of 90 PSI and average 180 degree F. temperature.

F. Counter Tops - Plastic Laminate

1. Deck shall consist of two layers of 3/4" (19 mm) particle board at the front edge and all other exposed edges providing a total thickness of 1 1/2" (40 mm). Solid patterns or wood grain colors of ONLY WILSONART brand high-pressure plastic laminate may be selected for the surfaces. The method of application of the laminate to the substrate shall be as recommended by the Decorative Plastic Laminate Association.

2. Provide loose back splashes without scribes.

G. Physical Properties shall meet minimally:

1. Flexural Strength ASTM-Method D-790 16,000/psi
2. Compressive Strength ASTM-Method D-695 36,500/psi
3. Hardness Rockwell M ASTM-Method D-785 110
4. Density Gr./CC. ASTM-Method D-792 123.55 lbs/ft³
5. Water Absorption ASTM-Method D-570 0.0076%

2.09 GLASS

A. Wall unit full sliding glass doors: ¼ inch laminated safety glass.

B. Glass insert doors, hinged or sliding wall cabinets: ¼ inch laminated safety glass.

C. Glass insert doors, hinged or sliding tall or base cabinets. ¼ inch laminate safety glass.

D. Sliding doors mounted in aluminum track.

E. Trim glass inserts: Extruded rigid PVC.

2.10 COLOR SELECTION
A. Laminate Color Selection:
   1. Select from the full range of ONLY Wilsonart®, standard color charts for cabinet faces, exposed ends, open interiors and countertops.

B. Hinge and Pull Color Selection:
   1. Select from full range of stock and custom colors to coordinate/match: Wilsonart®.

C. Miscellaneous Hardware Color Selection (support brackets, table frames, rail):
   1. Select from full range of stock and custom colors to coordinate/match: Wilsonart®.

D. 3mm PVC Edge Banding Color Selection:
   1. Select from full range of stock and custom colors to coordinate/match: Wilsonart®.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Installer must examine the job site and the conditions under which the work in this section is to be performed, and notify the Construction Manager in writing of any unsatisfactory conditions. Do not proceed with work under this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Casework, countertops, and related materials to be conditioned to average prevailing humidity condition in installation areas prior to start of work.

C. Install casework and countertops with factory-trained supervision authorized by manufacturer. Casework shall be installed plumb, level, true and straight with no distortions. (Shim as required). Securely attached to building structure with anchorage devices of appropriate type, size and quantity to meet applicable codes, specifications and safety conditions. Where laminate clad casework and countertops abuts other finished work, scribe and trim to accurate fit.

D. Adjust casework and hardware so that doors and drawers
operate smoothly without warp or bind. Lubricate operating hardware as recommended by the manufacturer.

E. Repair, or remove and replace, defective work as directed upon completion of installation.

F. Clean plastic surfaces, repair minor damage per plastic laminate manufacturer's recommendations. Replace other damaged parts of units.

G. Advise Construction Manager of procedures and precautions for protection of casework and countertops from damage by other trades until acceptance of work by Owner.

H. Cover casework with 4-mil polyethylene film for protection against soiling and deterioration during remainder of construction period.

END OF SECTION 12300
SECTION 15010 - MECHANICAL 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 work of this Section.

1.2 SUMMARY

A. This Section includes mechanical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 01 Specification Sections.

PART 2 - PRODUCTS

PART 3 - EXECUTION
1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

2. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
10. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
15. CDA - Copper Development Association; www.copper.org.
18. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
20. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.
1.4 PERFORMANCE REQUIREMENTS

A. Systems Components Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

1.5 QUALITY ASSURANCE

A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the mechanical systems as specified and as indicated on Drawings.

1. Contract Documents are complimentary, and what is required by one shall be as binding as if required by all. In the event of inconsistencies or disagreements within the Construction Documents bids shall be based on the most expensive combination of quality and quantity of the work indicated.

B. 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.

1. Notify the Architect/Engineer in writing before submitting a proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations.
2. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without notice to A/E, the Contractor shall bear all costs arising from corrective measures.

C. Source Limitations: Obtain equipment and other components of the same or similar systems through one source from a single manufacturer.

D. Tests and Inspections: Perform all tests required by state, city, county and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.

E. 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.

F. Sequence and Schedule: Perform work to avoid interference with the work of other trades. Remove and relocate work which in the opinion of the Owner’s Representatives causes interference.

G. Labeling Requirement for Packaged Equipment: Electrical panels on packaged mechanical equipment shall bear UL label or label of other Nationally Recognized Testing Laboratory (NRTL) (Intertek, CSA, etc.).

1.6 CODES, PERMITS AND FEES

A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for Mechanical Work shall be secured and paid for by the Contractor. All Work shall conform to all applicable codes, rules and regulations.

B. Rules of local utility companies shall be complied with. Check with each utility company supplying service to the installation and determine all devices including, but not limited to, all valves, meter boxes, and meters which will be required and include the cost of all such items in proposal.

C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

D. Refer to Division 15 Section “Domestic Water Piping” for purchase and installation of potable water meters.

1.7 DRAWINGS

A. The drawings show the location and general arrangement of equipment, piping and related items. They shall be followed as closely as elements of the construction will permit.
B. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly. Provide fittings, valves, and accessories as required to meet actual conditions.

C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.

D. The Architectural and Structural 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. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

1.8 MATERIAL AND EQUIPMENT MANUFACTURERS

A. Equipment: All 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.

B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of
equipment comply with these requirements including, but not limited to, piping, sheet metal, electrical work, and building alterations shall be included in the original Bid.

C. All package unit equipment and skid mounted mechanical components that are factory assembled shall meet, in detail, the products named and specified within each section of the Mechanical and Electrical Specifications.

D. Changes Involving Electrical Work: The design of the mechanical systems is based on the equipment scheduled on the Drawings. Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified with no additional cost to project. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1. Where equipment changes are made that involve additional Electrical Work (larger size motor, additional wiring of equipment, etc.) the Mechanical Trades involved shall compensate the Electrical Trades for the cost of the additional Work required.

1.9 INSPECTION OF SITE

A. Visit the site, examine and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.

B. No contract sum adjustments or contract time extensions will be made for Contractor claims arising from conditions which were or could have been observable, ascertainable or reasonably foreseeable from a site visit or inquiry into local conditions affecting the execution of the work.
1.10 ITEMS REQUIRING PRIOR APPROVAL

A. Bids shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 01 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.

1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.

2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, piping, sheet metal, electrical, replacement of other components, and building alterations shall be included in the original bid.

B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid, but will not affect the awarding of the contract.

1.11 SUBMITTALS

A. Submit project specific submittals for review in compliance with Division 01.

B. Prepare shop drawings to scale for the Architect/Engineer for review. Equipment and material submittals required are indicated in the Mechanical; Fire Suppression; Plumbing; and Heating, Ventilating and Air Conditioning Sections. Refer to Division 01 for submittal quantities.

C. All submittals shall be submitted in groupings of similar and/or related items. Plumbing fixture submittals shall be
submitted as one package including all fixtures intended to be used for this project. Incomplete submittal groupings will be returned “Rejected”. Submit shop drawing with identification mark number or symbol numbers as specified or scheduled on the Mechanical Drawings.

D. All submittals shall be project specific. Standard detail drawings and schedule not clearly indicating which data is associated with this Project will be returned “Rejected”.

E. 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.

F. No equipment shall be shipped from stock or fabricated until shop drawings for them have been reviewed by the Architect/Engineer. Review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Any action indicated is subject to the requirement of the plans and specifications.

1. 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.

2. Contractor is responsible for:

   a. Dimensions, which shall be confirmed and correlated at the job site.
   b. Fabrication processes and techniques of construction.
   c. Quantities.
   d. Coordination of Contractor’s work with all other trades.
   e. Satisfactory performance of Contractor’s work.
   f. Temporary aspects of the construction process.

G. Submit detailed shop drawings of piping systems showing pipe routing and types and locations of all pipe hangers.
H. If deviations (not substitutions) from Contract Documents are deemed necessary by the Contractor, details of such deviations, including changes in related portions of the project and the reasons therefore, shall be submitted with the submittal for approval.

1.12 COORDINATION DRAWINGS

A. Submit project specified coordination drawings for review in compliance with Division 01 Specification Sections.

1.13 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS

A. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 01 Specification Sections.

B. Provide complete operation and maintenance instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. One copy of all manuals shall be furnished for Owner. Maintenance and operating instructional manuals shall be provided when construction is approximately 75 percent complete.

C. Format: Submit operations and maintenance manuals in the following format:

   
   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
   
   b. Enable inserted reviewer comments on draft submittals.

D. The operating and maintenance instructions shall include a brief, general description for all mechanical systems including, but not limited to:

   1. Routine maintenance procedures.
2. Lubrication chart listing all types of lubricants to be used for each piece of equipment and the recommended frequency of lubrication.

3. Trouble-shooting procedures.

4. Contractor's telephone numbers for warranty repair service.

5. Submittals.

6. Recommended spare parts lists.

7. Names and telephone numbers of major material suppliers and subcontractors.

8. System schematic drawings.

1.14 RECORD DRAWINGS

A. Submit record drawings in compliance with Division 01.

B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media or vellum which have been neatly marked to represent as-built conditions for all new mechanical work.

C. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer and Owner at their request.

1.15 INSTRUCTION OF OWNER PERSONNEL

A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of mechanical equipment and systems at agreed upon times. A minimum of 24 hours of formal instruction to Owner's personnel shall be provided for each building. Additional hours are specified in individual specification sections.

B. For equipment requiring seasonal operation, perform instructions for other seasons within six months.

C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
D. In addition to individual equipment training provide overview of each mechanical system. Utilize the as-built documents for this overview.

E. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction.

1.16 WARRANTY

A. Warranty: Comply with the requirements in Division 01 Specification Sections. Contractor shall warranty that the mechanical installation is free from defects and agrees to replace or repair, to the Owner’s satisfaction, any part of this mechanical installation which becomes defective within a period of one year (unless specified otherwise in other Mechanical; Fire Suppression; Plumbing; or Heating, Ventilating and Air Conditioning Sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship or failure to follow the contract documents.

B. File with the Owner any and all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

PART 2 - PRODUCTS

A. Not Applicable

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION WORK

A. All demolition of existing mechanical equipment and materials shall be done by the Contractor unless otherwise indicated. Include all items such as, but not limited to, existing piping, draining of piping, pumps, ductwork, supports and equipment where such items are not required for the proper operation of the modified system.

B. In general, demolition work is indicated on the Drawings. However, the Contractor shall visit the job site to determine the full extent and character of this Work.
C. Unless specifically noted to the contrary, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the appropriate trade for reuse. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Remove items from the systems and turn over to the Owner in their condition prior to removal. The Owner shall move and store these materials. Items on which the Owner waives ownership shall become the property of the Contractor, who shall remove and legally dispose of same, away from the premises.

D. Work that has been cut or partially removed shall be protected against damage until covered by permanent construction.

E. Clean and flush the interior and exterior of all existing relocated equipment and its related piping, valves, and accessories that are to be reused of all mud, debris, pipe dope, oils, welding slag, loose mill scale, rust and other extraneous material so that the existing equipment and all accessories can be repainted and repaired as required to place in first-class working condition.

F. Where existing equipment is to be removed, cap piping under floor, behind face of wall, above ceiling or at mains. Cap or plug piping with same or compatible piping material.

G. Cap ductwork and cap piping immediately adjacent to demolition as soon as demolition commences in order to allow existing systems to remain in operation.

   1. Cap or plug piping with same or compatible piping material.
   2. Cap or plug ducts with same or compatible ductwork material.

3.2 REFRIGERANT HANDLING

A. Refrigerant Installation and Disposal: Perform all work related to refrigerant contained in chillers, cooling coils, air conditioners, and similar equipment, including related piping, in strict accordance with the following requirements:
2. ASHRAE Standard 34 and Related Revisions: Number Designation and Safety Classification of Refrigerants.
3. United States Environmental Protection Agency (US EPA) requirements of Section 808 (Prohibition of Venting and Regulation of CFC) and applicable State and Local regulations of authorities having jurisdiction.

B. Recovered refrigerant is the property of the Contractor. Dispose of refrigerant legally, in accordance with applicable rules and regulations.

3.3 WORK IN EXISTING BUILDINGS

A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once Work is started in the existing building, shall complete same without interruption so as to return work areas as soon as possible to Owner.

B. Adequately protect and preserve all existing and newly installed Work. Promptly repair any damage to same at Contractor's expense.

C. Consult with the Owner’s Representative as to the methods of carrying on the Work so as not to interfere with the Owner's operation any more than absolutely necessary. Accordingly, all service lines shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Owner's Representative.

D. Prior to starting work in any area, obtain approval for doing so from a qualified representative of the Owner who is designated and authorized by the Owner to perform testing and abatement, if necessary, of all hazardous materials including but not limited to, asbestos. The Contractor shall not perform any inspection, testing, containment, removal or other work that is related in any way whatsoever to hazardous materials under the Contract.

3.4 TEMPORARY SERVICES

A. Provide temporary 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 cost to the Owner.

3.5 WORK INVOLVING OTHER TRADES

A. Certain items of equipment or materials specified in the Mechanical Division may have to be installed by other trades due to code requirements or union jurisdictional requirements. In such instances, the Contractor shall complete the work through an approved, qualified subcontractor and shall include the full cost for same in proposal.

3.6 ACCEPTANCE PROCEDURE

A. Upon successful completion of start-up and recalibration, but prior to building acceptance, substantial completion and commencement of warranties, the Architect/Engineer shall be requested in writing to observe the satisfactory operation of all mechanical control systems.

B. The Contractor shall demonstrate operation of equipment and control systems, including each individual component, to the Owner and Architect/Engineer.

C. After correcting all items appearing on the punch list, make a second written request to the Owner and Architect/Engineer for observation and approval.

D. After all items on the punch list are corrected and formal approval of the mechanical systems is provided by the Architect/Engineer, the Contractor shall indicate to the Owner in writing the commencement of the warranty period.

E. Operation of the following systems shall be demonstrated:

1. Air Handling Systems.
2. Refrigeration Systems.
4. Domestic Hot Water Mixing Stations.
6. Temperature Controls.
F. For systems requiring seasonal operation, demonstrate system performance within six months when weather conditions are suitable.

END OF SECTION 15010
SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL.......................................................... 2
  1.1 RELATED DOCUMENTS.............................................. 2
  1.2 SUMMARY............................................................ 2
  1.3 DEFINITIONS.......................................................... 2
  1.4 SUBMITTALS.......................................................... 3
  1.5 QUALITY ASSURANCE.............................................. 3
  1.6 DELIVERY, STORAGE, AND HANDLING........................... 5
  1.7 COORDINATION....................................................... 5

PART 2 - PRODUCTS......................................................... 6
  2.1 MANUFACTURERS..................................................... 6
  2.2 PIPE, TUBE, AND FITTINGS........................................ 6
  2.3 JOINING MATERIALS............................................... 6
  2.4 PIPE THREAD COMPOUNDS......................................... 8
  2.5 TRANSITION FITTINGS........................................... 9
  2.6 DIELECTRIC FITTINGS............................................ 10
  2.7 MODULAR MECHANICAL SEALS.................................... 12
  2.8 SLEEVES............................................................ 12
  2.9 ESCUTCHEONS....................................................... 13
  2.10 GROUT ........................................................... 13
  2.11 EPOXY BONDING COMPOUND................................. 14
  2.12 PIPE ROOF PENETRATION ENCLOSURES......................... 14

PART 3 - EXECUTION....................................................... 14
  3.1 PIPING SYSTEMS - COMMON REQUIREMENTS...................... 14
  3.2 PIPING JOINT CONSTRUCTION.................................... 20
  3.3 ACCESS DOORS..................................................... 24
  3.4 EQUIPMENT CONNECTIONS......................................... 24
  3.5 PIPING CONNECTIONS............................................... 24
  3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS............ 25
  3.7 PAINTING........................................................... 26
  3.8 CONCRETE BASES................................................... 26
  3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES.............. 26
  3.10 EPOXY BONDING TO EXISTING MATERIALS..................... 27
  3.11 JACKING OF PIPE............................................... 27
  3.12 ERECTION OF WOOD SUPPORTS AND ANCHORAGES............. 27
  3.13 GROUTING ....................................................... 28
  3.14 CUTTING, CORING AND PATCHING................................ 28
  3.15 EXCAVATION AND BACKFILLING.................................. 28
  3.16 FLASHING........................................................ 29
  3.17 LUBRICATION..................................................... 29
  3.18 FILTERS.......................................................... 29
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. Related Sections include the following:
   1. Division 15 Section “Mechanical General Requirements.”
   2. Division 15 Section “Domestic Water Piping” for flushing and cleaning of potable water piping.
   3. Division 15 Section “Piping Systems Flushing and Chemical Cleaning” for flushing and cleaning of HVAC piping.

1.2 SUMMARY

A. This section includes mechanical materials and installation methods common to mechanical piping systems, sheet metal systems and equipment. This section supplements all other Division 13 Fire Protection Sections, Division 15 Mechanical Sections, and Division 01 Specification 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, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in 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. CPVC: Chlorinated polyvinyl chloride plastic.
   2. PE: Polyethylene plastic.
   3. PVC: Polyvinyl chloride plastic.
   4. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
   5. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

G. The following are industry abbreviations for rubber materials:
   1. EPDM: Ethylene-propylene-diene terpolymer rubber.
   2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Transition fittings.
   2. Dielectric fittings.
   3. Mechanical sleeve seals.
   4. Escutcheons.

B. Welding certificates.

C. Brazing Certificates: As required by ASME Boiler and Pressure Vessel Code, Section IX, or AWS B2.2.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water
Act," about lead content in materials that will be in contact with potable water for human consumption.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.


D. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

E. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

F. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

G. Soldering: Qualify processes and operators according to AWS B2.3/2.3M, "Specification for Soldering Procedure and Performance Qualification."

H. Installer Qualifications:

1. Installers of Grooved Components: Installers shall be certified by the grooved component manufacturer as having been trained and qualified to join piping with grooved couplings, fittings, and specialties.
2. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Provide adequate weather protected storage space for all mechanical equipment and materials deliveries to the job site. Storage locations will be designated by the Owner’s Representative. Equipment stored in unprotected areas must be provided with temporary protection.

1. Protect equipment and materials from theft, injury or damage.
2. Protect equipment outlets, pipe and duct openings with temporary plugs or caps.
3. Materials with enamel or glaze surface shall be protected from damage by covering and/or coating as recommended in bulletin “Handling and Care of Enameled Cast Iron Plumbing Fixtures”, issued by the Plumbing Fixtures Manufacturer Association, and as approved.
4. Electrical equipment furnished by Mechanical Trades and installed by the Electrical Trades: Turn over to Electrical Trades in good condition, receive written confirmation of same.
5. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations. Coordinate with other trades to ensure accurate locations and sizes of mechanical spaces, chases, slots, shafts, recesses and openings.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Install Work to avoid interference with work of other trades including, but not limited to, Architectural and Electrical Trades. Remove and relocate any work that causes an interference at Contractor's expense.
D. Coordinate requirements for and provide access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

E. The mechanical trades shall be responsible for all damage to other work caused by their work or through the neglect of their workers.

1. All patching and repair of any such damaged work shall be performed by the trades which installed the work. The cost shall be paid by the Mechanical Trades.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Unions: Pipe Size 2 Inches and Smaller:

1. Ferrous pipe: Malleable iron ground joint type unions.
2. Unions in galvanized piping system shall be galvanized.
3. Copper tube and pipe: Bronze unions with soldered joints.
C. Flanges: Pipe Sizes 2-1/2 Inch and Larger:

2. Copper tube and pipe: Slip-on bronze flanges.

D. 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.

E. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated. Square head bolts and nuts are not acceptable.

F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

G. Solder Filler Metals: ASTM B 32, lead-free, antimony-free, silver-bearing alloys. Include water-flushable flux according to ASTM B 813.

H. Brazing Filler Metals: Alloys meeting AWS A5.8.

1. Use Type BcuP Series, silver-bearing, copper-phosphorus alloys for joining copper or bronze socket fittings with copper pipe. Flux is prohibited unless used with bronze fittings.
2. Use Type Bag Series, cadmium-free silver alloys for joining copper with steel, stainless steel, or other ferrous alloys.

J. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.


L. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.


N. Solvent Cements for Joining PVC to ABS Piping Transition: ASTM D 3138.

O. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 PIPE THREAD COMPOUNDS

A. Pipe thread compounds for the fluid service compatible with piping materials provided.

B. Compounds for potable water service and similar applications acceptable to U.S. Department of Agriculture (USDA) or Food and Drug Administration (FDA). Compounds containing lead are prohibited.

C. Inorganic zinc-rich coatings or corrosion inhibited proprietary compounds for galvanized carbon steel systems to coat raw carbon steel surfaces, in lieu of subsequent painting.

   1. Manufacturers:

      a. Carboline "Carbo-Zinc 12."
      b. Tnemec.
      c. Koppers.
D. Graphite and oil or proprietary corrosion inhibited compounds suitable for system temperatures for steam or condensate.

1. Manufacturers:
   a. WKM; Division of Cooper Industries, Inc., Key "Graphite Paste."
   b. Other approved.

E. Use tetrafluoroethylene (Teflon) tape 2 to 3 mils thick for natural gas system threaded joints.

1. Manufacturers:
   b. Permacel.
   c. Other approved.

2.5 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:
   b. Dresser Industries, Inc.; DMD Div.
   c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
   d. JCM Industries.
   e. Smith-Blair, Inc.
   f. Viking Johnson.

2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
1. Manufacturers:
   a. IPEX Inc. (formerly Eslon Thermoplastics).

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:
   a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:
   a. NIBCO INC.
   b. NIBCO, Inc.; Chemtrol Div.

E. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:
   b. Fernco, Inc.
   d. Plastic Oddities, Inc.
   e. Can-Tex Industries Division of Harsco Corp. “CT-Adaptors”.
   f. Joint Inc., “Caulder”.

2.6 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.
C. Brass Unions, Brass Nipples, Brass Couplings: For systems up to 286 deg F.

D. Dielectric-Flange Kits: Include full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Capitol Manufacturing Co.
   d. Central Plastics Company.
   e. Epco Sales, Inc.
   f. Pipeline Seal and Insulator, Inc.
   g. Watts Water Technologies, Inc.; Watts Regulator Co.
   h. Zurn Industries, Inc.; Wilkins Div.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; female NPT threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:
   a. Lochinvar Corp.; V-Line Insulating Couplings.

F. Dielectric Nipple/Waterway Fittings: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, male NPT threaded, or grooved ends; and 300-psig minimum working pressure at 230 deg F.

1. Manufacturers:
   b. Elster Group; Perfection Corp.; ClearFlow.
   d. Sioux Chief Manufacturing Co., Inc.
   e. Tyco Fire & Building Products; Grinnell Mechanical Products; Figure 407 ClearFlow.
2.7 MODULAR MECHANICAL SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve or pipe and core drilled hole.

1. Manufacturers:
   
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.; Thunderline Link Seal.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Carbon steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.8 SLEEVES

A. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, and 0.375 inch wall black.

B. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, and 0.375 inch wall galvanized, plain ends.

C. Water Stop: Cast or ductile-iron; fabricated steel; PVC; or rotationally molded HDPE pipe; with plain ends and integral water stop, unless otherwise indicated.

1. Manufacturers:
   
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.
D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.9 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

1. New Piping:
   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping or Piping in High Humidity Areas: One-piece, cast-brass type with polished chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type with spring clips.
   d. Bare Piping in Finished Spaces: One-piece, stamped-steel type.
   e. Bare Piping in Unfinished Service Spaces or Equipment Rooms: Split-plate, stamped-steel type with concealed hinge and set screw.

2. Existing Piping: Use the following:

   a. Chrome-Plated Piping or Piping in High Humidity Areas: Split-casting, cast-brass type with chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
   c. Bare Piping: Split-plate, stamped-steel type with set screw or spring clips.

2.10 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

2. Design Mix: 5000-psi, 28-day compressive strength.

2.11 EPOXY BONDING COMPOUND

A. Two-component system suitable for bonding wet or dry concrete to each other and to other materials.

B. Manufacturers:

1. Euco 452 #450; Euclid Chemical Co.
2. Epobond; L & M Construction Chemicals.
3. Sikadur 87; Sika Corp.

2.12 PIPE ROOF PENETRATION ENCLOSURES

A. Manufacturers:

1. Pate Company (The).
2. Portals Plus, Inc.
3. Thybar Corporation; Thycurb.

B. Minimum 18 gage welded galvanized steel construction.

C. Integral base plate.

D. Built-in fully mitered cant.

E. Factory installed insect and decay resistant wood nailer.

F. Factory installed 1-1/2 inch thick, 3 pounds per cubic foot density rigid insulation.

G. EPDM compression molded rubber cap for single or multiple pipes as required.

H. Stainless steel draw-band clamps.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Refer to piping application schedules on the Drawings.

B. Install piping according to the following requirements and Division 15 Sections specifying piping systems, and in accordance with manufacturer’s instructions.
C. 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. The Drawings shall be followed as closely as elements of construction will permit.

D. During the progress of construction, protect open ends of pipe, fittings, and valves to prevent the admission of foreign matter. Place plugs or flanges in the ends of all installed work whenever work stops. Plugs shall be commercially manufactured products.

E. Prior to and during laying of pipe, maintain excavations dry and clear of water and extraneous materials. Provide minimum 4 inches of clearance in all directions for pipe passing under or through building grade beams.

F. Weld-o-lets and thread-o-lets can be used for annular flow measuring devices, temperature control components, and thermal wells in steel pipe. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.

G. Brazolets can be used for annular flow measuring devices, temperature control components, and thermal wells in copper tube. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.

H. Clean and lubricate elastomer joints prior to assembly.

I. Clean damaged galvanized surfaces and touch-up with a zinc rich coating.

J. Install piping to conserve building space and not interfere with use of space.

K. Group piping whenever practical at common elevations.

L. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

M. Slope piping and arrange systems to drain at low points.

N. Slope horizontal piping containing noncondensible gases 1 inch per 100 feet, upward in the direction of the flow.
O. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

P. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

Q. In concealed locations where piping, other than black steel, cast-iron, or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1-1/2 inches from the nearest edge of the member, the pipe shall be protected by shield plates. Protective shield plates shall be a minimum of 1/16 inch thick steel, shall cover the area of the pipe where the member is notched or bored, and shall extend a minimum of 2 inches above sole plates and below top plates.

R. Do not penetrate building structural members unless specifically indicated on drawings.

S. Install piping above accessible ceilings to allow sufficient space for ceiling panel and light fixture removal.

T. Install valves with stems upright or horizontal, not inverted.

U. Provide clearance for installation of insulation and access to valves and fittings.

V. Install piping to permit valve and equipment servicing. Do not install piping below valves and/or terminal equipment. Do not install piping above electrical equipment.

W. Install piping at indicated slopes. Provide drain valves with hose end connections and caps at all piping low points, where piping is trapped and at all equipment.

X. Install piping free of sags and bends.

Y. Install fittings for changes in direction and branch connections.
Z. Unless otherwise indicated or specified, install branch connections to mains using tee fittings in main pipe:

1. Branch connected to bottom of main pipe for HVAC systems. Side connection is acceptable. Connection above centerline of main is unacceptable. For up-feed risers, connect branch to top of main pipe.
2. Branch connected to top of main for steam and condensate, plumbing systems, compressible gasses, and vacuum.

AA. Install piping to allow application of insulation.

BB. Select system components with pressure rating equal to or greater than system operating pressure.

CC. After completion, fill, clean, and treat systems. Refer to Division 15 Sections “Hydronic Piping,” “Piping Systems Flushing and Chemical Cleaning,” and “HVAC Water Treatment.”

DD. Install escutcheons for penetrations of walls below ceiling, and ceilings.

EE. Sleeves are not required for core-drilled holes in poured concrete walls.

FF. Permanent sleeves are not required for holes formed by removable PE sleeves in poured concrete walls.

GG. Install sleeves for pipes passing through footings and foundation walls, masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces of walls.
   a. Exception: Extend sleeves installed in floors 2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
a. Schedule 40 Black Steel Sleeves: For pipes smaller than NPS 12 penetrating interior walls.
b. 0.375 Inch Wall Black Steel Sleeves: For pipes NPS 12 and larger penetrating interior walls.
c. Schedule 40 Galvanized Steel Sleeves: For pipes smaller than NPS 12 penetrating floors, and roof slabs.
d. 0.375 Inch Wall Galvanized Steel Sleeves: For pipes NPS 12 and larger penetrating floors and roof slabs.
e. For pipes penetrating floors with membrane waterproofing, provide cast iron sleeve with clamping flanges. Secure/seal membrane to sleeves with clamping flanges.

4. Seal sleeves in concrete floors, roof slabs, and masonry walls with grout.

5. Seal sleeves in plaster/gypsumboard partitions with plaster or drywall compound and caulk with non-hardening silicone sealant to provide airtight installation.

6. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

HH. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and modular mechanical seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing modular mechanical seals.

1. Install Schedule 40 galvanized steel pipe for sleeves smaller than 12 inches in diameter.

2. Install 0.375 galvanized steel pipe for sleeves 12 inches and larger in diameter.

3. Modular Mechanical Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble modular mechanical seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
II. New, Poured Concrete, Underground, Exterior-Wall and Slab on Grade Pipe Penetrations: Install water stop sleeves prior to pour. Seal pipe penetrations using modular mechanical seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing modular mechanical seals.

1. Modular Mechanical Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble modular mechanical seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

JJ. Existing Underground, Exterior-Wall and Slab on Grade Pipe Penetrations: Seal core drilled pipe penetrations using modular mechanical seals. Allow for 1-inch annular clear space between pipe and cored opening for installing modular mechanical seals.

1. Modular Mechanical Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of cored hole. Assemble modular mechanical seals and install in annular space between pipe and cored opening. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

KK. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Specification Sections for materials.

LL. 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. Fire and/or smoke barriers shall be UL listed firestopping and shall have a fire rating equal to or greater than the penetrated barrier. Refer to Division 07 Specification Sections for materials.

MM. Pipe Roof Penetration Enclosures:
1. Coordinate delivery of roof penetration enclosures to jobsite.
2. Locate and set curbs on roof.
3. Framing, flashing, and attachment to roof structure are specified under Division 07.
4. Attach cap to curbs, cut pipe boots to fit pipe, and clamp boots to pipe or conduit.

NN. Verify final equipment locations for roughing-in.

OO. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Cut piping square.

C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

D. Remove scale, slag, dirt, oil, and debris from inside and outside of pipe and fittings before assembly.

E. Clean damaged galvanized surfaces and touch-up with a zinc rich coating.

F. Use standard long sweep pipe fittings for changes in direction. No mitered joints or field fabricated pipe bends will be permitted. Short radius elbows may be used where specified or specifically authorized by the Architect.

G. Make tee connections with screwed tee fittings, soldered fittings or specified welded connections. Make welded branch connections with either welding tees or forged branch outlet fittings in accordance with ASTM A234, ANSI B16.9 and ANSI B16.11. For forged branch outlets, furnish forged fittings flared for improved flow where attached to the run, reinforced against external strains and to full pipe-bursting strength requirements. "Fishmouth" connections are not acceptable.
H. Use eccentric reducers for drainage and venting of pipe lines; bushings are not permitted.

I. Provide pipe openings using fittings for all systems control devices, thermometers, gauges, etc. Drilling and tapping of pipe wall for connections is prohibited.

J. Provide temperature sensing device thermal wells and similar piping specialty connections.

K. Provide instrument connections except thermal wells with specified isolating valves at point of connection to system.

L. Locate instrument connections in accordance with manufacturer’s instructions for accurate read-out of function sensed. Locate instrument connections for easy reading and service of devices.

M. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

N. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

O. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

P. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

1. Weld-o-lets and thread-o-lets can be used for annular flow measuring devices, temperature control components, and thermal wells. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.
Q. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on gaskets and bolt threads.

1. Assemble flanged joints with fresh-stock gasket and hex head nuts, bolts or studs. Make clearance between flange faces such that the connections can be gasketed and bolted tight without strain on the piping system. Align flange faces parallel and bores concentric; center gaskets on the flange faces without projection into the bore.

2. Lubricate bolts before assembly to insure uniform bolt stressing. Draw up and tighten bolts in staggered sequence to prevent unequal gasket compression and deformation of the flanges. Do not mate a flange with a raised face to a companion flange with a flat face; machine the raised face down to a smooth matching surface and use a full face gasket. After the piping system has been tested and is in service at its maximum temperature, check bolting torque to provide required gasket stress.

R. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Galvanized piping shall be cut grooved to prevent damage to galvanizing on internal pipe surfaces. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer’s representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.

S. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.
T. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

U. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials. Refer to Application Schedules on the Drawings.

V. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

W. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

X. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

Y. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

Z. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

AA. Remake joints which fail pressure tests with new materials including pipe, fittings, gaskets and/or a filler.
3.3 ACCESS DOORS

A. Provide access doors for installation by architectural trades. Provide access doors in the walls, as required to make all valves, controls, coils, motors, air vents, filters, electrical boxes and other equipment installed by the Contractor accessible. Minimum size 12 inches x 12 inches. Provide access doors in the ceiling, for accessibility as mentioned above, 24 inches x 24 inches minimum size. Areas with accessible ceilings (ceilings where lay-in panels are not fastened in place and can be individually removed without removal of adjacent tiles) will not require access doors. Refer to Division 08 Section “Access Doors and Frames” for manufacturers and model numbers and additional information.

B. When access doors are in fire resistant walls or ceilings, they shall bear the Underwriters' Laboratories, Inc., Label, with time design rating equal to or greater than the wall or ceiling unless they were a part of the tested assembly.

3.4 EQUIPMENT CONNECTIONS

A. Make connections to equipment, fixtures, and other items included in the work in accordance with the submittals and rough-in measurements furnished by the manufacturers of the particular equipment furnished.

1. Any and all additional connections not shown on the drawings but shown on the equipment manufacturer’s submittal or required for the successful operation of the equipment shall be installed as part of this Contract at no additional charge to the Owner.

B. All piping connections to pumps, coils, and other equipment shall be installed without strain at the pipe connection of this equipment. When directed, remove the bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, where indicated on Drawings, at final connection to each piece of equipment and at all control valves.

2. Install flanges, in piping NPS 2-1/2 and larger, where indicated on Drawings, at final connection to each piece of equipment and at all control valves.

3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated. Housekeeping pad locations and sizes shall be coordinated by mechanical contractor prior to the placement of concrete slabs.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. 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.

D. Install equipment to allow right of way for piping installed at required slope.

E. For suspended equipment, furnish and install all inserts, rods, structural steel frames, brackets and platforms required. Obtain approval of Architect for same including loads, locations and methods of attachment.

F. Equipment Rigging Over Roof Areas: Protect building structure against damage during equipment rigging. Make provisions to distribute load of equipment to main roof structure, and to prevent damage to roof decking, roofing, or purlins.

G. The Contract Documents indicate items to be purchased and installed. The items are noted by a manufacturer’s name, catalog number and/or brief description. The catalog number may not designate all the accessory parts for a particular application. Arrange with the manufacturer for the purchase of all items required for a complete installation.
3.7 PAINTING

A. Painting of mechanical systems, equipment, and components is specified in Division 09.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 CONCRETE BASES

A. Concrete housekeeping pads for floor mounted mechanical equipment shall be provided by Architectural Trades.

B. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases as shown on Drawings or specified, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section.

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Where pipe and/or equipment support members must be welded to structural building framing, Contractor shall seek prior approval from Architect and structural engineer. Scrape, brush clean, and apply one coat of zinc rich primer after welding.

D. Field Welding: Comply with AWS D1.1.

3.10 EPOXY BONDING TO EXISTING MATERIALS

A. Use epoxy bonding compound to set sleeves or pipes in existing concrete to bond new concrete and/or grout to existing materials or to bond dissimilar materials.

B. The compound, when applied in accordance with the manufacturer's instructions, shall be capable of initial curing within 48 hours at temperatures as low as 40 deg F and shall be capable of bonding any combination of the following properly prepared materials: Wet or dry, cured or uncured concrete or mortar; vitrified clay; cast iron and carbon steel.

3.11 JACKING OF PIPE

A. Do not jack pipe in place except upon prior approval of proposed materials and complete details of methods.

3.12 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages 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.
3.13 **GROUTING**

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.14 **CUTTING, CORING AND PATCHING**

A. Refer to Division 01 Specification Sections for requirements for cutting, coring, patching and refinishing work necessary for the installation of mechanical work.

B. All cutting, coring, patching and repair work shall be performed by the Contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

3.15 **EXCAVATION AND BACKFILLING**

A. Refer to Division 02 Specification Sections.

B. Provide all excavation, trenching, tunneling and backfilling required for the mechanical work.

C. Provide all pumping and/or well pointing required for the mechanical work.

D. Provide foundations if required to support underground piping.

E. Backfill all excavations with well-tamped granular material. Backfill all excavations under wall footings.
with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.

3.16 FLASHING

A. Provide all flashing required for mechanical work. Refer to Division 07 Specification Sections.

3.17 LUBRICATION

A. Provide all lubrication for the operation of the equipment until acceptance by the Owner. Contractor is responsible for all damage to bearings up to the date of acceptance of the equipment. Protect all bearings and shafts during installation. Thoroughly grease steel shafts to prevent corrosion. Provide covers as required for proper protection of all motors and other equipment during construction.

3.18 FILTERS

A. Provide and maintain filters in air handling systems throughout the construction period and prior to final acceptance of the building. Do not run air handling equipment, including fan coil units, without all prefilters and final filters as specified.

B. Immediately prior to final building acceptance by the Owner, Contractor shall:

1. Thoroughly wash, recharge and reinstall cleanable type air filters.
2. Replace all disposable type air filters with new units.

3.19 CLEANING

A. Each Mechanical Trade shall be responsible for removing all debris daily as required to maintain the work area in a neat, orderly condition.
B. After equipment, steam, condensate and HVAC water piping systems have been completed and tested, each entire system shall be cleaned and flushed. Refer to Division 15 Section "Piping Systems Flushing and Chemical Cleaning" for requirements. Provide temporary bypass piping and fittings, temporary valves and strainers, temporary water make-up piping with approved means of backflow prevention, and temporary pumps as needed to perform specified flushing and cleaning requirements.

C. Prior to connection of new HVAC piping to existing HVAC piping systems, all new piping shall be subject to initial flushing, cleaning and final flushing. Refer to Division 15 Section "Piping Systems Flushing and Chemical Cleaning" for requirements. Provide temporary bypass piping and fittings, temporary valves and strainers, temporary water make-up piping with approved means of backflow prevention, and temporary pumps as needed to perform specified flushing and cleaning requirements.

D. Flushing, cleaning, and disinfection of domestic water piping is specified in Division 15 Section “Domestic Water Piping.”

E. Exterior surfaces of all piping, ductwork and equipment shall be wiped down to remove excess dirt and debris prior to concealment by Architectural Trades work.

F. Upon completion of work in each respective area, clean and protect work. Just prior to final acceptance, perform additional cleaning as necessary to provide clean equipment and areas to the Owner.

END OF SECTION 15050
SECTION 15053 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 15 Section “Mechanical General Requirements.”
2. Division 15 Section “Basic Mechanical Materials and Methods.”
3. Division 15 Section “Testing, Adjusting, and Balancing.”
1.2 SUMMARY

A. This Section includes common requirements for existing fans and air moving equipment.

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Fan bearings.
   2. V-belt fan drives.
   3. Direct drive couplings.

1.4 QUALITY ASSURANCE

A. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.


C. Sound Power Level Ratings:

1. Ducted Fans - Rated per AMCA 301, when tested per AMCA 300.
2. Nonducted Fans - Rated in Zones at 5 feet from acoustic center of fan rated per AMCA 301, tested per AMCA 300 and converted per AMCA 302.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not operate equipment for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.
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 FAN SHAFTS

A. Fan Shafts: Ground from solid cold rolled steel, and proportioned to run at least 25 percent below the first critical speed.

2.3 FAN POWER TRANSMISSION


B. A given manufacturer's V-belt drive, as applied to specific equipment provided under the Contract, shall conform to the equipment manufacturer's published recommendations, except as otherwise specified.

C. Base horsepower rating of drive on minimum pitch diameter of small sheave.

D. Locate belt drives outboard of bearings. Align drive and driven shafts by the four-point method.

E. Adjust belt tension in accordance with the manufacturer's recommendations.

F. Perform alignment and final belt tensioning in the presence of the Architect.
2.4 SHEAVES

A. Furnish sheaves of machined cast iron or carbon steel, bushing type of fixed bore, secured to the shaft by key and keyway.

B. For all constant speed fans at or above 2 inches of total static pressure, Contractor shall provide and install two sets of fixed sheaves. First set shall be installed for initial start-up and shall be based on scheduled data. The second set shall be installed after system balance is complete and shall be based on actual field conditions.

C. For all constant speed fans below 2 inches total static pressure, Contractor shall provide and install two sets of adjustable sheaves. First set shall be installed for initial start-up and shall be based on scheduled data. The second set shall be installed after the balance is complete and shall be based on actual field conditions, and selected at mid-range of the sheave.

D. Set pitch diameters of fixed pitch and adjustable or variable pitch sheaves when adjusted as specified, at not less than that recommended by NEMA Standard MG1-14.42.

E. For companion sheaves for adjustable or variable pitch drives, furnish wide groove spacing to match driving sheaves.

F. For all variable frequency controller (VFC) operated fans, contractor shall provide and install one set of fixed sheaves sized to allow full utilization of fan motor horsepower provided, with VFC at 100 percent of fan motor RPM.

2.5 V-BELT FAN DRIVES

A. Fan Drives: Multiple V-belt style with adjustable pitch driver sheaves for fans up to 2 inches of total static pressure and fixed pitch driver sheaves for fans at or above 2 inches of total static pressure and up. Sheaves shall have split, taper style bushings. Drives shall be selected for a 150 percent service factor and shall provide for adjustment of both belt tension and alignment.

B. Manufacturers:
1. Emerson Power Transmission; Browning.
2. Rockwell Automation; Dodge.
3. T.B. Wood’s Incorporated.

2.6 FAN DRIVE, SHAFT, AND COUPLING GUARDS

A. Safety Provisions: Include guards and screens for power transmission equipment, but do not negate vibration isolation provision.

B. Furnish ANSI and OSHA compliant mechanical power transmission apparatus guards except where superseded by other governing codes, and except as modified and supplemented. Requirements specified apply to all types of fans.

C. Fabricate mechanical power transmission device guards such that the completed structure is capable of withstanding a load of at least 200 pounds applied in any direction.

D. Furnish a guard enclosure for each V-belt drive, coupling, shaft, and rotating component. Secure guards in place, easily removable for maintenance. Guard fasteners used for maintenance access shall be "captive type." Locate holes on each guard for tachometer readings on both the motor and fan shafts. Fabricate guard of minimum 16 gage sheet metal with hemmed edges at openings for shafts. Weld four mounting lugs or feet of 10 gage material to the guard. Furnish holes in mounting feet sized for suitable machine screws.

E. Centrifugal exhaust fans shall be provided with shaft seals.

2.7 BELT DRIVE GUARDS

A. Belt Guards: ANSI and OSHA compliant with provision for readily viewing belt tension and measuring shaft speeds. Guards shall be installed with quick release pins, so that removal of three to five clip pins, will allow the guard to be removed from fan housing.

B. Fabricate guards which completely enclose moving parts of the particular drive. Design and construct guards of such rigidity as to contain a belt which breaks during
operation. Minimum material thickness, 16 gage sheet metal. Where ventilation is required, perforated metal shall be used for the sides. Fabricate top of solid sheet metal.

2.8 V-BELTS

A. Notched or cogged style, endless type, of Dacron reinforced elastomer construction, with cross-section to suit sheave grooves. Determine the number of V-belts from the motor horsepower to which apply the service factor to obtain the design horsepower. Determine the corrected horsepower per belt by multiplying the nominal horsepower per belt by an arc of contact factor not greater than 0.85. Divide the design horsepower by the corrected horsepower per belt to obtain the number of belts required. In any case, furnish not less than two belts for each drive.

B. Furnish belts that have been factory or factory-authorized distributor matched and measured on a belt-matching machine. Selection by "code numbers," "sag numbers" or "match numbers" is not acceptable. Bind each belt set with wire and tag with equipment identification.

C. Manufacturers:

1. Emerson Power Transmission; Browning; AX, BX, and CX Series and 3VX and 5VX Series.
2. Rockwell Automation; Dodge; Classic Cog and Narrow Cog V-Belts.
3. T.B. Wood’s Incorporated; Classical Cog and Narrow Cog V-Belts.

2.9 V-BELT DRIVE MOTOR BASES

A. Furnish fan motors with slide or adjustable pivoted bases wherever equipment configuration permits proper installation.

B. Provide for adjustment of both belt tension and alignment.

2.10 AIR HANDLING SYSTEM BALANCING PROVISIONS

A. Provide extra sheaves, sized as recommended by the Balancing Agent, for the adjustment of fan speed for each
air handling system during air quantity balancing operations. Furnish sheaves as specified in this Section.

B. Provide sheaves, sized as recommended by the Balancing Agent, for the adjustment of fan speed for each existing air handling system requiring rebalancing during air quantity balancing operations. Furnish sheaves as specified in this Section.

2.11 FLEXIBLE COUPLINGS (DIRECT DRIVE)

A. Fan shaft shall be connected to the motor shaft through a flexible coupling. The flexible member shall be a tire shape, in shear, or a solid mass serrated edge disc shape, made of chloroprene materials and retained by fixed flanges. Flexible coupling shall act as a dielectric connector and shall not transmit sound, vibration or end thrust.

B. Manufacturer:

1. Falk Corporation (The).

2.12 MOTOR REQUIREMENTS

A. Furnish motors in accordance with Division 15 Section “Motors.”

2.13 FAN BEARINGS

A. Bearings: Anti-friction ball or roller type with provision for self-alignment and thrust load. Made in U.S.A. with ABMA L10 minimum life of 200,000 hours. Use cast iron housings and dust-tight seals suitable for lubricant pressures.

1. Lubrication Provisions - Use surface ball check type supply fittings. Provide extension tubes to allow safe maintenance while equipment is operating. Provide manual or automatic pressure relief fittings to prevent overheating or seal blow-out due to excess lubricant or pressure. Arrange relief fittings opposite supply but visible for normal maintenance observation.

2. Bearings on Equipment with less than 1/2 horsepower rating or on shafts smaller than 1-3/4 inch in
diameter: Permanently sealed, pre-lubricated anti-friction bearings per specified materials and ABMA $L_{10}$ life requirements.

2.14 IDENTIFICATION

A. Nameplate: Affix metallic, corrosion-resistant data plate for each fan in a conspicuous location. Include selection point capacity conditions.

2.15 ACCESSORIES

A. Bird Screens: Of material to match adjacent contact construction, 1/2 inch mesh or equal expanded metal. Use on inlet or outlet of each nonducted fan.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Field Rigging: Do not negate balancing. Do not bend shaft. Use lifting eyes.

B. Install sheaves where recommended by Testing, Adjusting, and Balancing agency.

C. Refer to individual Division 15 HVAC equipment Sections for additional requirements.

END OF SECTION 15053
SECTION 15055 - MOTORS

PART 1 - GENERAL..........................................................1

1.1 RELATED DOCUMENTS..................................................1

1.2 SUMMARY...............................................................2

1.3 DEFINITIONS...........................................................2

1.4 QUALITY ASSURANCE..................................................2

1.5 COORDINATION........................................................2

PART 2 - PRODUCTS..........................................................4

2.1 MANUFACTURERS.......................................................4

2.2 MOTOR REQUIREMENTS................................................4

2.3 MOTOR CHARACTERISTICS..........................................5

2.4 POLYPHASE MOTORS..................................................5

2.5 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS..........9

2.6 SINGLE-PHASE MOTORS...............................................10

2.7 ENCLOSED CONTROLLERS............................................11

2.8 ENCLOSED SWITCHES AND CIRCUIT BREAKERS.....................11

2.9 FUSES..................................................................11

PART 3 - EXECUTION........................................................11

3.1 FIELD QUALITY CONTROL............................................11

3.2 ADJUSTING............................................................12

3.3 CLEANING.............................................................12

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. Related Sections include the following:

1. Division 15 “Mechanical General Requirements.”

2. Division 15 Section "Mechanical Vibration Controls" for mounting motors and vibration isolation devices.

3. Division 15 Section “Variable Frequency Controllers”.

4. Division 15 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

5. Division 16 Section “Enclosed Switches and Circuit Breakers”.

6. Division 16 Section “Enclosed Controllers”.

MOTORS 15055 - 1
7. Division 16 Section “Fuses”.

1.2 SUMMARY

A. This Section includes basic requirements for factory-installed motors.

1.3 DEFINITIONS

A. ABMA: American Bearing Manufacturers Association. (Formerly AFBMA: Anti-Friction Bearing Manufacturers Association.)

B. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.

C. Packaged Self Contained Equipment: Equipment which includes component mechanical and electrical equipment mounted on common bases, skids or frames or in common enclosures with internal control and power wiring factory installed and ready to accept a single electrical service connection. Provide the equipment complete with enclosed controllers, main disconnect switches, control transformers, control devices, wiring and accessories as required.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL), acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:

1. Compatible with the following:
2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.

3. Matched to torque and horsepower requirements of the load.

4. Matched to ratings and characteristics of supply circuit and required control sequence.

B. Coordinate electrical scope of work to be provided by Division 15 with this Section, related Division 15 Specifications, Division 16 Specifications and the Drawings.

C. Electrical work provided under Division 15: Furnish UL Listed components in accordance with this section, Division 16, and applicable NEMA and NEC (ANSI C 1) requirements. Provide wiring, external to electrical enclosures, in conduit.

D. Furnished, installed and wired under Division 15 unless otherwise indicated:

1. Disconnected components in packaged self-contained equipment that are so constructed that components of wiring must be disconnected for shipment and reconnected after installation.

E. Furnished and installed under Division 15 and wired under Division 16 unless otherwise indicated:

1. Motors required for mechanical equipment

2. Packaged Self-Contained Equipment:

   a. Provide equipment ready to accept a single electrical service connection.

   b. For equipment with remote mounted control panels, provide mounting of the control panel and external wiring from the control panel to the package self-contained equipment.
3. Variable frequency controllers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Dayton.
2. Toshiba Intl.
7. Regal Beloit/Leeson.
8. Regal Beloit/Marathon.
9. Siemens.

2.2 MOTOR REQUIREMENTS

A. Motor requirements apply to factory-installed motors except as follows:

1. Different ratings, performance, or characteristics for a motor are specified in another Section.
2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.
3. Submersible motors integral to pumps and excluded from NEMA and EISA standards.

B. Electrical Power Supply Characteristics: Coordinate electrical system requirements with Division 16.


D. Electrical Connection: Conduit connection boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide screwed conduit connection in end frame.
2.3 MOTOR CHARACTERISTICS
   
   A. Motors 1/2 HP and Larger: Three phase, unless otherwise indicated.
   
   B. Motors Smaller Than 1/2 HP: Single phase, unless otherwise indicated.
   
   C. Frequency Rating: 60 Hz.
   
   D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
   
   E. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
   
   F. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
   
   G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
   
   H. Brake Horsepower Input: Shall not exceed 90 percent of the rated motor horsepower.
   
   I. Enclosure: Open dripproof (ODP) for motors installed indoors and out of the airstream. Totally-enclosed fan-cooled (TEFC) for motors installed outdoors or within the airstream.

2.4 POLYPHASE MOTORS
   
   A. Description: NEMA MG 1, Design B, medium induction motor.
   
   B. Efficiency: Fire pump motors, C-face motors, JP and JM frame motors, and motors over 200 horsepower shall be energy efficient motors. Efficiency of the motor shall be determined based on the NEMA MG1. The minimum efficiencies, nominal efficiencies and shall meet or exceed Table 12-11.
### 1800 RPM OPEN DRIP-PROOF MOTORS

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### 1200 RPM OPEN DRIP-PROOF MOTORS

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### 3600 RPM OPEN DRIPPROOF MOTORS

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C. Efficiency: Motors 1 horsepower to 200 horsepower shall be premium efficient motors meeting requirements of NEMA Premium Efficiency Motor Program. Efficiency of the motor shall be determined based on the NEMA MG1. The nominal efficiencies shall meet or exceed Table 12-12.
## Nominal Efficiencies for “NEMA Premium™” Induction Motors

### Rated 600 Volts or Less (Random Wound)

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### Nominal Efficiencies for “NEMA Premium™” Induction Motors

#### Rated Medium Volts for 5kV or Less (Form Wound)

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D. Stator: Copper windings, unless otherwise indicated.

E. Rotor: Squirrel cage, unless otherwise indicated.
F. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 120,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

G. Temperature Rise: Match insulation rating, unless otherwise indicated.

H. Insulation: Class F, unless otherwise indicated.

I. Code Letter Designation:
   1. Motors 10 HP and Larger: NEMA starting Code (KVA Code) F or G.
   2. Motors Smaller Than 10 HP: Manufacturer's standard starting characteristic.
   3. Fire Pump Motors: NEMA starting Code (KVA Code) B.

J. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.
   1. Finish: Gray enamel.

K. Sound Level: Not to exceed NEMA MG-1 12.54.

2.5 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
   1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
   2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
C. Shaft Grounding: Provide a means to protect motor from common mode currents.

1. Required for:
   a. Motors used with variable frequency controllers.
   b. Motors 100 HP and larger.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

D. Severe-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with nonhygroscopic material.

1. Finish: Chemical-resistant paint over corrosion-resistant primer.

E. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:

1. Measure winding resistance.
2. Read no-load current and speed at rated voltage and frequency.
3. Measure locked rotor current at rated frequency.
4. Perform high-potential test.

2.6 SINGLE-PHASE MOTORS

A. Type: One of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split-phase start, capacitor run.
3. Capacitor start, capacitor run.

B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.

C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature
rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.

2.7 ENCLOSED CONTROLLERS

A. Provide enclosed controllers in accordance with requirements specified in Division 16 Section “Enclosed Controllers”.

2.8 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

A. Provide enclosed switches and circuit breakers in accordance with requirements specified in Division 16 Section “Enclosed Switches and Circuit Breakers”.

2.9 FUSES

A. Provide fuses in accordance with requirements specified in Division 16 Section “Fuses”.

PART 3 – EXECUTION

3.1 FIELD QUALITY CONTROL

A. All three phase motors 1/2 HP and above shall be tested by the Testing Agency.

B. Prepare for acceptance tests as follows:

1. Check motor nameplates for horsepower, speed, phase and voltage.
2. Check coupling alignment and shaft end play.
3. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
4. Test interlocks and control features for proper operation.
5. Verify that current in each phase is within nameplate rating.
C. Testing: Perform the following field quality-control testing:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.
2. Jog motor as required to verify proper phase and shaft rotation. Immediately after start-up, check bearing temperature and smooth operation. Take current reading at full load using a clamp-on ammeter. If ammeter reading is over the rated full load current, determine reason for discrepancy and take necessary corrective actions. Record all readings, motor nameplate data and overload heater data.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.2 ADJUSTING

A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

3.3 CLEANING

A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 15055
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. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 13 Section "Fire-Suppression Piping" for pipe hangers for fire-protection piping.
3. Division 15 Section "Mechanical General Requirements."
4. Division 15 Section "Basic Mechanical Materials and Methods."
5. Division 15 Section "Mechanical Vibration Controls" for vibration isolation devices.
6. Division 15 Section "Pipe Expansion Fittings and Loops" for pipe guides and anchors.
7. Division 15 Section(s) "Metal Ducts" and "Nonmetal Ducts" for duct hangers and supports.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
B. MFMA: Metal Framing Manufacturers Association.

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
   2. Thermal-hanger shield inserts.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze pipe hangers. Include Product Data for components.
   2. Metal framing systems. Include Product Data for components.
   3. Pipe stands. Include Product Data for components.
   4. Equipment supports.
C. Welding certificates.

1.5 QUALITY ASSURANCE

A. MSS Standards: Pipe hangers, supports, and accessories shall comply with the following:

1. MSS SP-58, Pipe Hangers and Supports – Materials, Design and Manufacture.
2. MSS SP-69, Pipe Hangers and Supports – Selection and Application.
3. MSS SP-89, Pipe Hangers and Supports – Fabrication and Installation Practices.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 HANGER ROD MATERIAL

A. Threaded, hot rolled, steel rod conforming to ASTM A 36 or A575.

1. Rod continuously threaded.
2. Use of rod couplings is prohibited.
2.3 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-69, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article, and schedules and details on the Drawings for where to use specific hanger and support types.

1. Hangers and Supports for Fire Protection Piping: UL listed or FMG approved.

B. Manufacturers:

1. Anvil International, Inc.
2. B-Line by Eaton.
3. Carpenter & Paterson, Inc.
4. Hilti USA.
5. ERICO International Corp.
6. PHD Manufacturing, Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.4 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.5 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

2. B-Line by Eaton.
4. Unistrut Corp.; Tyco International, Ltd.
5. Hilti USA.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

E. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.6 METAL INSULATION SHIELDS

A. Manufacturers:
   1. Anvil International, Inc.
   2. B-Line by Eaton.
   3. Carpenter & Paterson, Inc.
   4. ERICO International Corp.
   5. PHD Manufacturing, Inc.

B. Description: MSS SP-69, Type 40, protective shields. Shields shall span an arc of 180 degrees.

C. Shield Dimensions for Pipe: Not less than the following:
   1. NPS 1/4 to NPS 2: 12 inches long and 0.048 inch thick.

2.7 PIPE COVERING PROTECTION SADDLES

A. Manufacturers:
   1. Anvil International, Inc.
   2. B-Line by Eaton.
   3. Carpenter & Paterson, Inc.
   4. ERICO International Corp.
   5. PHD Manufacturing, Inc.

B. Description: MSS SP-69, Type 39A and Type 39B, for suspension of insulated hot pipe where heat losses are to be kept to a minimum.
   1. Saddles shall match insulation thickness.
   2. Saddle length: 12 inches.
3. Furnish with center rib for pipe sized NPS 12 and larger.

2.8 THERMAL-HANGER SHIELDS

A. Manufacturers:
   2. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
   5. ERICO International Corp.
   6. Value Engineered Products, Inc.

B. Description: Manufactured assembly consisting of insulation insert encased in 360 degree sheet metal shield.

   1. Minimum Compressive Strength of Insert Material:
      a. 100-psig- for sizes smaller than NPS 6.
      b. 600-psig- for sizes NPS 6 and larger.

C. Insulation-Insert Material for Cold Piping: Full 360 degree, water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Full 360 degree, water-repellent treated, ASTM C 533, Type I calcium silicate.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

F. Include carbon steel ASTM A36 load distribution plates as required by load, pipe movement, hanger style, and hanger spacing.

G. Thermal-Hanger Shields for Flexible Foamed Elastomeric Insulated Piping:
   1. Manufacturer:
      a. B-Line by Eaton/Armacell; Armafix IPH.
2. Insulation-Insert Material for Copper Piping with Flexible Foamed Elastomeric Insulation: Use the following:

a. Flexible foamed elastomeric, ASTM 534, Type I-Tubular Grade 1 with PUR/PIP support inserts.

H. Thermal-Hanger Shields for Small Diameter Piping:

1. Manufacturer:

   a. Hydra-Zorb Company; Klo-Shure Insulation Couplings.

2. Insulation-Insert Material for Small Diameter Piping with Flexible Foamed Elastomeric or Glass Fiber Insulation: Use the following:

   a. Rigid Hytrel thermoplastic insulation coupling designed for use with pipe or tube NPS 1-1/2 and smaller, and insulation from 3/8 inch to 1-1/2 inch thick.

2.9 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

   b. Empire Industries, Inc.
   c. Hilti, Inc.
   d. ITW Ramset/Red Head.
   e. MKT Fastening, LLC.
   f. Powers Fasteners.

B. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application. Exception: Do not use chemical fasteners to support hanger systems for fire protection piping.

1. Manufacturers:
a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. MKT Fastening, LLC.
d. Powers Fasteners.

2. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.


C. Threaded Inserts: Galvanized malleable iron or galvanized steel for 3/4 inch bolts.

1. Manufacturers:
   a. Superior Concrete Accessories; Threaded Insert.
   b. Dayton Sure-Grip and Shore Co.
   c. Richmond Screw Anchor Co.

D. Slotted Inserts: Continuous galvanized steel with temporary slot fillers and complete with nuts, studs, washers and the like, for 3/4 inch bolts.

1. Manufacturers:
   a. B-Line by Eaton; B22-I Continuous Concrete Insert.
   b. Unistrut Corp.; P-3200 Continuous Insert.
   c. Hohman and Barnard, Inc.
   d. Richmond Screw Anchor Co.
   e. Hilti, Inc.; CIS13812/PG.

2.10 ROOF MOUNTED PIPING SUPPORTS

A. Low, Fixed-Height, Single-Base Stand: Assembly of base and horizontal member, and pipe support, for roof installation without membrane penetration.

1. Manufacturers:
   a. B-Line by Eaton; Dura-Blok.
   b. Eco Support Products.
   c. ERICO International Corp.
   d. MIRO Industries; Conduit and Condensate Supports.
e. Portable Pipe Hangers.

2. Base: Plastic, stainless steel, or recycled rubber.
3. Horizontal Member: Cadmium-plated-steel or galvanized-steel strut designed for use with standard strut clamps and accessories.

B. Low, Fixed-Height, Single-Base Roller Stand: Assembly of base and horizontal roller, for roof installation without membrane penetration.

1. Manufacturers:
   a. B-Line by Eaton; Dura-Blok.
   b. Eco Support Products.
   c. ERICO International Corp.
   d. MIRO Industries; Gas and Mechanical Supports.
   e. Portable Pipe Hangers.

2. Base: Plastic, stainless steel, or recycled rubber.
3. Horizontal Member: Cadmium-plated-steel rod and corrosion resistant roller designed for use with standard accessories.

C. Custom, Multiple-Base Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports or rollers, for roof installation without membrane penetration.

1. Manufacturer:
   a. B-Line by Eaton; Dura-Blok.
   b. Eco Support Products.
   c. ERICO International Corp.
   d. MIRO Industries; Custom Design Products.
   e. Portable Pipe Hangers.

2. Bases: Four or more plastic, steel, or recycled rubber.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
6. Pipe Rollers: Cadmium-plated-steel rod and corrosion resistant roller designed for use with standard accessories.

D. Curb-Mounting Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

1. Roof Curb Type Supports: Coordinate installation and type with Architectural Trades. Top shall be level and extend a minimum of 10 inches above top of roof insulation.
   a. Manufacturers:
      1) Pate.
      2) Thybar; Thycurb.
      3) Roof Products and Systems.
      4) Greenheck.
      5) Creative Metals.

2.11 ROOF MOUNTED EQUIPMENT SUPPORTS

A. Non-Penetrating Equipment Supports: Assembly of two or more bases and horizontal members, for roof installation without membrane penetration.

1. Manufacturers:
   a. B-Line by Eaton; Dura-Blok.
   b. Eco Support Products.
   c. ERICO International Corp.
   d. MIRO Industries; HD and LD Mechanical Unit Supports.
   e. Portable Pipe Hangers.

2. Base: Plastic, stainless steel, or recycled rubber.

3. Horizontal Member: Cadmium-plated-steel, galvanized-steel, or stainless steel strut, and planking; designed for use with standard strut clamps, all-thread rood, and accessories.

B. Roof Rail-Type Equipment Stands: Welded 18 gage galvanized steel shell, base plate and counter flashing.
Factory installed chemically treated wood nailer. Fully mitered end sections. Internal bulkhead reinforcement.

1. Roof Rail Type Supports: Coordinate installation and type with Architectural Trades. Top shall be level and extend a minimum of 10 inches above top of roof insulation.
   a. Manufacturers:
      1) Pate.
      2) Thybar; TEMS Series.
      3) Roof Products and Systems.
      4) Greenheck.
      5) Creative Metals.

2.12 EQUIPMENT SUPPORTS
   A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.13 MISCELLANEOUS MATERIALS
   A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
   B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
      2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS
   A. Refer to application schedules on the Drawings.
   B. For insulated pipe, oversize hanger elements to accommodate insulation thickness.
   C. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
D. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

E. Use hangers and supports with galvanized, metallic coatings for outdoor applications or where exposed to outdoor conditions.

F. Use hangers and supports with plastic coating, or galvanized metallic coatings for applications in corrosive atmospheres.

G. Use metal framing, with plastic coating, or galvanized metallic coatings for metal framing in corrosive atmospheres.

H. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

I. Use padded hangers for piping that is subject to scratching.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. MSS Type 8 or spring type to meet system requirements.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
L. Concrete Structure Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Anchor Devices, Concrete and Masonry: in accordance with Group I, Group II, Type 2, Class 2, Style 1 and Style 2, Group III and Group VIII or FS FF-S-325A. Furnish cast-in floor type equipment anchor devices with adjustable positions. Furnish built in anchor devices for masonry, unless otherwise approved by the Architect. Powder actuated anchoring devices shall not be used to support any mechanical systems components.

2. Inserts, Concrete: TYPE 18 or 19. When applied to loads equivalent to piping in sizes NPS 2 and larger, and where otherwise required by imposed loads, a one foot length of 1/2 inch NPS 4 reinforcing rod shall be inserted and wired through wing slots. Proprietary type continuous inserts may be proposed and shall be submitted for approval.

3. Use mechanical-expansion anchors where required in concrete construction.

4. Use chemical fasteners where required in concrete construction.

M. Steel Frame Structure Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Beam Clamps:

   a. Center Loading: TYPE 21, 28, 29 and 30, unless otherwise indicated. Type 27 shall be allowed to support single pipes NPS 6 size or smaller only.

   b. "C" Clamps: Type 19, 20 or 23, for supporting single pipes NPS 2-1/2 size or smaller only. Use of "C" clamps, or beam clamps of "C" pattern, or any modification thereof, is prohibited for supporting multiple pipes or pipes larger than NPS 2-1/2.

N. Hanger-Rod Attachments for Wood Construction: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. All Steel Ceiling Plates: UL listed and suitable for attachment to wood beams. For pipe sizes NPS 1/2 to
NPS 2. Install in accordance with manufacturer’s instructions to maintain listing.

2. Threaded Side Beam Brackets: UL listed and FMG approved, suitable for attachment to wood beams. For pipe sizes NPS 2 to NPS 4. Install in accordance with manufacturer’s instructions to maintain listing.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Use spring supports and sway braces TYPES 48, 49, 50, 51, 52, 53, 54, 55 or 56. For specific points:
   a. Provide spring supports at point of support where vertical movement will occur.
   b. For light loads and vertical movement less than 1/4 inch, TYPES 48 or 49 spring cushion supports.
   c. For vertical movements in excess of 1/4 inch but less than 1/2 inch, TYPES 51, 52 or 53 variable spring supports shall be used, loaded to not more than 75 percent of published load rating.
   d. For vertical movements of 1/2 inch and more, TYPES 54, 55 and 56 constant support spring hangers.
   e. Sway braces; TYPE 50.
   f. Variable spring hangers in accordance with referenced MSS Standards with "medium" allowable load change.

P. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structural frame.

B. Provide necessary piping and equipment supporting elements including: building structure attachments, supplementary
steel, hanger rods, stanchions and fixtures, vertical pipe attachments, horizontal pipe attachments, anchors, guides, spring supports in accordance with the referenced codes, standards, and requirements specified. Support piping and equipment from building structure, not from roof deck, floor slab, other pipe, duct or equipment.

C. At connections between piping systems, hangers and equipment of dissimilar metals, insulate, using dielectric insulating material, nonferrous piping against direct contact with the building steel by insulating the contact point of the hanger and pipe or the hanger and building steel. Test each point of dielectric insulation with an ohm meter to ensure proper isolation of dissimilar materials. Test shall be observed by the Owner's Representative and/or Architect.

D. Use copper plated or plastic coated supporting element in contact with copper tubing or glass piping.

E. File and paint cut ends and shop or field prime paint supporting element components.

F. Hang piping parallel with the lines of the building, unless otherwise indicated. Route piping in an orderly manner and maintain gradient. Space piping and components so a threaded pipe fitting may be removed between adjacent pipes and so there will be not less than 1/2 inch of clear space between finished surfaces and piping. Arrange hangers on adjacent parallel service lines in line with each other.

G. Flange loads on connected equipment shall not exceed 75 percent of maximum allowed by equipment manufacturer. Flange loads in liquid containing systems shall be checked in the presence of the Architect when piping is full of liquid. No flange load is allowed on pumps, vibration isolated equipment or flexible connectors.

H. Spring supports, within specified limitations: Constant support type, where necessary to avoid transfer of load from support to support or onto connected equipment; otherwise, variable support type located at points subject to vertical movement.
I. Incorporate pipe anchors into piping systems to maintain permanent pipe positions. Install alignment guides for the piping adjacent to and on each side of pipe expansion loops and expansion joints to maintain alignment.

J. Where necessary, brace piping and supports against reaction, sway and vibration.

K. Do not hang piping from joist pans, floor decks, roof decks, equipment, ductwork, or other piping.

L. Install turnbuckles, swing eyes and clevises to accommodate temperature changes, pipe accessibility, and adjustment for load pitch. Rod couplings are not acceptable.

M. Install hangers and supports for piping at intervals specified, at locations not more than 3 feet from the ends of each runout, not more than 3 feet from connections to equipment, and not over 25 percent of specified interval from each change in direction of piping and for concentrated loads such as valves, etc.

N. Base the load rating for pipe support elements on loads imposed by insulated weight of pipe filled with water. The span deflection shall not exceed slope gradient of pipe.

O. If structural steel, roofs, or tunnels will allow support spacing greater than that shown above, Contractor shall submit proposed support system along with structural calculations documenting the allowance of such spacing, in accordance with ANSI, B31.1, and MSS Guidelines.

P. Support vertical risers independently of connected horizontal piping whenever practical, with supports at the base and at intervals to accommodate system range of load with thermal conditions. Support vertical risers at each floor penetration for piping in shafts or chases. Guide for lateral stability. Fit horizontal piping connected to moving risers with two spring supports connected adjacent to riser, spaced according to required hanger spacing.

Q. For risers at temperatures of 100 deg F or less place riser clamps under fittings. Support carbon steel pipe at each operating level or floor and at not more than 15-foot
intervals for pipe 2 inches and smaller, and at not more than 20 foot intervals for pipe 2-1/2 inches and larger.

R. After the piping systems have been installed, tested and placed in satisfactory operation, firmly tighten hanger rod nut and jam nut and upset threads to prevent movement of fasteners.

S. Attach pipe anchors and pipe alignment guides to the building structure where indicated. If not indicated, the method used is optional to the Contractor, subject to approval by the Architect. In the case of structural steel, make attachment by clamping in accordance with the American Institute of Steel Construction Specification for the Design, Fabrication and Erection of Structural Steel for Building.

T. Attach supporting elements connected to structural steel columns to preclude vertical slippage and cascading failure.

U. Attach pipe hangers and other supporting elements to roof purlins and trusses at panel points.

V. Where eccentric loading beam clamps are approved and where other work is supported by similar eccentric loading support element from the same structural member, locate eccentric loading support elements to minimize structural member torsion load.

W. Limit the location of supporting elements for piping and equipment, when supported from roof, to panel points of the bar joists.

X. Building structure shall not be reinforced except as approved by the Architect in writing.

Y. Use approved cast-in-place inserts or built-in anchors for attachment to concrete structure. Size inserts and anchors for the total applied load with a safety factor in accordance with applicable codes but in no case less than 5. Coordinate installation of all imbedded items in accordance with manufacturer's instructions. Position anchorage and imbedded items as indicated and/or where required and support against displacement during placing of concrete. Cutting or repositioning of concrete beam or
girder or reinforcing steel to accommodate inserts will not be allowed. Provide removable closures in imbedded device openings to prevent entry of concrete.

Z. Support piping and equipment from concrete building frame, not from roof or floor slabs unless otherwise indicated.

AA. Use cast-in-place inserts in concrete beams and girders. Drilled anchors/wedge type inserts shall be used on vertical surfaces only. Coordinate with structural engineer.

BB. Attach piping supports to the side of concrete beams and concrete joist. Provide supplementary support steel as required. Cast-in-place or drilled anchors will not be permitted in the bottom of concrete beams and concrete joist.

CC. Attach piping supports to the side of concrete beams or concrete joist. Where intermediate hangers are required to meet the hanger spacing schedule, the Contractor may propose attachment of intermediate pipe supports to the bottom of the concrete slab pending submittal of a satisfactory pull out test. The Contractor shall submit pull out test criteria, pull out test results, proposed hanger detail and hanger point loads to the Architect for written approval.

DD. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

EE. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

FF. Fastener System Installation:
1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

GG. Roof-Mounting Pipe and Equipment Stand Installation:

1. Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb or Rail Mounting Type Stands: Assemble components or fabricate stand and mount on permanent, stationary roof curb or rail. Refer to Division 07 Section "Roof Accessories" for curb and rail installation.
3. Maintain support manufacturer’s recommended spacing.

HH. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.


JJ. 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.

KK. Install lateral bracing with pipe hangers and supports to prevent swaying.

LL. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

MM. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

NN. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections
allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060
SECTION 15075 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL.................................................................1
  1.1 RELATED DOCUMENTS.......................................................1
  1.2 SUBMITTALS.........................................................................1
  1.3 QUALITY ASSURANCE.............................................................2
  1.4 COORDINATION......................................................................2

PART 2 - PRODUCTS.................................................................2
  2.1 MANUFACTURERS....................................................................2
  2.2 EQUIPMENT IDENTIFICATION DEVICES......................................3
  2.3 PIPING IDENTIFICATION DEVICES.............................................4
  2.4 DUCT IDENTIFICATION DEVICES..............................................5
  2.5 VALVE TAGS..........................................................................5
  2.6 VALVE SCHEDULES...............................................................6
  2.7 WARNING TAGS......................................................................6

PART 3 - EXECUTION.................................................................6
  3.1 APPLICATIONS, GENERAL.....................................................6
  3.2 EQUIPMENT IDENTIFICATION................................................6
  3.3 PIPING IDENTIFICATION........................................................8
  3.4 DUCT IDENTIFICATION........................................................9
  3.5 VALVE-TAG INSTALLATION....................................................9
  3.6 VALVE-SCHEDULE INSTALLATION........................................10
  3.7 HAZARDOUS MATERIAL IDENTIFICATION DEVICES.................10
  3.8 WARNING-TAG INSTALLATION...............................................10
  3.9 ADJUSTING.........................................................................10
  3.10 CLEANING.........................................................................10
  3.11 SCHEDULES.......................................................................10

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. Related Sections include the following:

1. Division 15 Section “Mechanical General Requirements.”

1.2 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.

1.3 QUALITY ASSURANCE


1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. 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 manufacturers specified:

1. Seton.
2. Brady.
3. EMED.
5. Brimar Industries, Inc.
2.2 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.
   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.

C. Equipment 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. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Data: Instructions for operation of equipment and for safety procedures.
2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
3. Thickness: Minimum 1/16 inch, unless otherwise indicated.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

D. Access Panel and Door Markers: 1/16-inch-thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.3 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME (ANSI) A13.1, unless otherwise indicated.
2. Type and Size of Letters: Comply with ANSI A13.1, unless otherwise indicated.
3. Legends: Spelled out in full or commonly used and accepted abbreviations.
4. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
5. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
6. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. 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.

E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.

2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

F. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4mil thick, manufactured for direct burial service.

G. Detectable Underground Pipe Markers: Continuously printed plastic ribbon tape with detectable aluminum core and with colors meeting APWA requirements, not less than 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.4 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow, air handling unit or fan number, and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

B. Duct Markers: Vinyl, 2-inch minimum character height, with permanent pressure sensitive adhesive. Include direction and quantity of airflow, air handling unit or fan number, and duct service (such as supply, return, and exhaust).

2.5 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 to match existing numbering scheme. Provide 5/32-inch hole for fastener.

1. Material: 0.032-inch thick brass.
2. Valve-Tag Fasteners: Brass wire-link chain or beaded chain.
2.6 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: Finished hardwood or extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.7 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.

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. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
4. Fans, blowers, primary balancing dampers, and mixing boxes.
5. Packaged HVAC central-station and zone-type units.

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. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
   c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
   d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
   e. Fans, blowers, primary balancing dampers, and mixing boxes.
   f. Packaged HVAC central-station and zone-type units.
   g. Tanks and pressure vessels.
C. Install access panel markers with screws on equipment access panels.

D. Area Served: Equipment serving different areas of a building other than where the equipment is installed shall be permanently marked in a manner that, in addition to identifying the equipment as specified in this Section, also identifies the area it serves.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.

2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, minimum 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.

3. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.

4. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, minimum 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

C. Underground Pipe Markers: Install 6 to 8 inches below finished grade, directly above buried pipe.

3.4 DUCT IDENTIFICATION

A. Identify ductwork with vinyl markers and flow direction arrows.

B. Locate markers at air handling units, each side of floor and wall penetrations, near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; 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: Minimum 1-1/2 inches, round or square.
   b. Hot Water: Minimum 1-1/2 inches, round or square.
   c. Fire Protection: Minimum 1-1/2 inches, round or square.
   d. Gas: Minimum 1-1/2 inches, round or square.
   e. Steam: Minimum 1-1/2 inches, round or square.
3.6 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.7 HAZARDOUS MATERIAL IDENTIFICATION DEVICES

A. Mount to wall or door of room containing hazard. Indicate classification of refrigerant or other hazard.

3.8 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.9 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.10 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

3.11 SCHEDULES

A. Paint colors are listed here for reference only. Painting is specified under Division 9.

PIPE LABELING AND COLOR CODING

<table>
<thead>
<tr>
<th>Pipe System Label</th>
<th>Drawing Abbrev.</th>
<th>San</th>
<th>Labels</th>
<th>Piping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanitary Sewer</td>
<td>SAN</td>
<td>SAN</td>
<td>White on Green</td>
<td>Dark Brown</td>
</tr>
<tr>
<td>Sanitary Vent</td>
<td>V</td>
<td></td>
<td>White on Green</td>
<td>Dark Brown</td>
</tr>
<tr>
<td>Rain Conductor</td>
<td>RC</td>
<td></td>
<td>White on Green</td>
<td>Dark Brown</td>
</tr>
<tr>
<td>Acid Waste</td>
<td>AW</td>
<td></td>
<td>Black on Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Acid Vent</td>
<td>AV</td>
<td></td>
<td>Black on Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Domestic Cold Water</td>
<td>CW</td>
<td></td>
<td>White on Green</td>
<td>Light Green</td>
</tr>
<tr>
<td>High Pressure Domestic Cc</td>
<td>HPCW</td>
<td></td>
<td>White on Green</td>
<td>Light Green</td>
</tr>
</tbody>
</table>

MECHANICAL IDENTIFICATION 15075 - 10
### Pipe System Label | Drawing Abbrev. | Labels | Piping
---|---|---|---
Non-Potable Cold Water | NPCW | Black on Yellow | Green
Domestic Hot Water | HW | Black on Yellow | Dark Green
High Pressure Domestic Hot Water | HPHW | Black on Yellow | Dark Green
High Pressure Domestic Hot Water Return | HPHWR | Black on Yellow | Dark Green
Domestic Hot Water Return | HWR | Black on Yellow | Dark Green
Soft Cold Water | SCW | White on Green | Light Green
Soft Hot Water | SHW | White on Green | Dark Green
Soft Hot Water Return | SHWR | White on Green | Dark Green
Natural Gas | G | Black on Yellow | Yellow
Fuel Oil Supply | FOS | Black on Yellow | Yellow
Fuel Oil Return | FOR | Black on Yellow | Yellow
Compressed Air (90psig) | A(90psig) | Black on Yellow | Dark Blue
Compressed Air (25psig) | A | White on Green | Dark Blue
Laboratory Vacuum | LVAC | Black on Yellow | Unpainted
Carbon Dioxide | CO₂ | Black on Yellow | Unpainted
High Purity Water | DI | White on Green | White
Hot Water Htg. Supply | HWHS | Black on Yellow | Dark Blue
Hot Water Htg. Return | HWHR | Black on Yellow | Dark Blue
Terminal Unit Heating Supply | THS | Black on Yellow | Dark Blue
Terminal Unit Heating Return | THR | Black on Yellow | Dark Blue
Animal Heating Supply | AHS | Black on Yellow | Dark Blue
<table>
<thead>
<tr>
<th>Pipe System Label</th>
<th>Drawing Abbrev.</th>
<th>Labels</th>
<th>Piping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal Heating Return</td>
<td>AHR</td>
<td>Black on Yellow Dark Blue</td>
<td></td>
</tr>
<tr>
<td>Energy Recovery Loop Sup.</td>
<td>ERLS</td>
<td>Black on Yellow Dark Blue</td>
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</tr>
<tr>
<td>Energy Recovery Loop Ret.</td>
<td>ERLR</td>
<td>Black on Yellow Dark Blue</td>
<td></td>
</tr>
<tr>
<td>Chilled Water Supply</td>
<td>CHWS</td>
<td>White on Green Light Blue</td>
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<td>Chilled Water Return</td>
<td>CHWR</td>
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<td>Condenser Water Supply</td>
<td>CWS</td>
<td>White on Green Light Green</td>
<td></td>
</tr>
<tr>
<td>Condenser Water Return</td>
<td>CWR</td>
<td>White on Green Light Green</td>
<td></td>
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<td>Process Cooling Water Sup.</td>
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<td>White on Green Light Green</td>
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<td>PCWR</td>
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<td>Refrigerant Suction</td>
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<td>Steam Condensate</td>
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<td>MPC</td>
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<tr>
<td>High Pressure Steam Condensate</td>
<td>HPC</td>
<td>Black on Yellow Aluminum</td>
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<td>Pumped Steam Condensate</td>
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<tr>
<td>Medium Pressure Steam (60 psig)</td>
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<td>Fire Protection</td>
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<td>White on Red Bright Red</td>
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<td>Medical Gases</td>
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<td>Refer to Division 15 Section “Medical Gas Systems.”</td>
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**MECHANICAL IDENTIFICATION**

**SHEET METAL WORK**

Service Abbrev. Labels Ductwork
<table>
<thead>
<tr>
<th>Pipe System Label</th>
<th>Drawing Abbr.</th>
<th>Labels</th>
<th>Piping</th>
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<tbody>
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<td>Outside Air Intake</td>
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<td>Mixed Air</td>
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<td>White</td>
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END OF SECTION 15075
SECTION 15080 - MECHANICAL INSULATION

PART 1 - GENERAL
1.1 RELATED DOCUMENTS
1.2 SUMMARY
1.3 DEFINITIONS
1.4 INDOOR PIPING INSULATION SYSTEMS DESCRIPTION
1.5 INDOOR DUCT AND PLENUM INSULATION SYSTEMS DESCRIPTION
1.6 EQUIPMENT INSULATION SYSTEMS DESCRIPTION
1.7 FIELD-APPLIED JACKETING SYSTEMS DESCRIPTION
1.8 SUBMITTALS
1.9 QUALITY ASSURANCE
1.10 DELIVERY, STORAGE, AND HANDLING
1.11 COORDINATION
1.12 SCHEDULING

PART 2 - PRODUCTS
2.1 INSULATION MATERIALS, GENERAL REQUIREMENTS
2.2 PIPE INSULATION MATERIALS
2.3 DUCTWORK INSULATION MATERIALS
2.4 EQUIPMENT INSULATION MATERIALS
2.5 FIRE-RATED INSULATION SYSTEMS
2.6 INSULATING CEMENTS
2.7 ADHESIVES
2.8 MASTICS
2.9 SEALANTS
2.10 FACTORY-APPLIED JACKETS
2.11 FIELD-APPLIED JACKETS
2.12 REMOVABLE AND REUSABLE INSULATION COVERS
2.13 TAPES
2.14 SECUREMENTS
2.15 CORNER ANGLES

PART 3 - EXECUTION
3.1 EXAMINATION
3.2 PREPARATION
3.3 COMMON INSTALLATION REQUIREMENTS
3.4 PENETRATIONS
3.5 GENERAL PIPE INSULATION INSTALLATION
3.6 FLEXIBLE ELASTOMERIC PIPE INSULATION INSTALLATION
3.7 GLASS-FIBER AND MINERAL WOOL PIPE INSULATION INSTALLATION
3.8 DUCT AND PLENUM INSULATION INSTALLATION
3.9 DUCT LAGGING INSTALLATION
3.10 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION
3.11 FIELD-APPLIED JACKET INSTALLATION .......................... 37
3.12 FIRE-RATED INSULATION SYSTEM INSTALLATION .......... 39
3.13 FINISHES ...................................................... 39

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. Related Sections include the following:

1. Division 02 Section “Underground Hydronic Distribution Piping” for preinsulated piping systems.
2. Division 02 Section “Underground Steam and Condensate Distribution Piping” for preinsulated piping systems.
3. Division 15 Section “Mechanical General Requirements.”
4. Division 15 Section “Basic Materials and Methods.”
5. Division 15 Section “Hanger and Supports” for thermal hanger shield inserts.
6. Division 15 Section “Plumbing Fixtures: for protective shielding guards.”
7. Division 15 Section “Medical Plumbing Fixtures” for protective shielding guards.
8. Division 15 Section "Metal Ducts" for duct liners.

1.2 SUMMARY

A. This Section includes mechanical insulation for pipe, duct, and equipment.

1.3 DEFINITIONS

A. ASJ: All-service jacket.
B. FSK: Foil, scrim, kraft paper.
C. FSP: Foil, scrim, polyethylene.
D. PVC: Polyvinyl Chloride.
E. PVDC: Polyvinylidene chloride.
F. SSL: Self-sealing lap.
1.4 INDOOR PIPING INSULATION SYSTEMS DESCRIPTION

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are scheduled on the Drawings, or identified for each piping system and pipe size range.

1.5 INDOOR DUCT AND PLENUM INSULATION SYSTEMS DESCRIPTION

A. Acceptable indoor duct and plenum insulation materials and thicknesses are scheduled on the Drawings.

1.6 EQUIPMENT INSULATION SYSTEMS DESCRIPTION

A. Acceptable equipment insulation materials and thicknesses are scheduled on the Drawings.

1.7 FIELD-APPLIED JACKETING SYSTEMS DESCRIPTION

A. Acceptable field-applied jacketing materials and thicknesses are scheduled on the Drawings.

1.8 SUBMITTALS

A. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Attachment and covering of heat tracing 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, equipment connections, and access panels.
6. Application of field-applied jackets.
7. Application at linkages of control devices.
8. Field application for each equipment type
9. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.
1.9 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Ductwork Maximum Temperature Limits: Based on ASTM C 411 test procedures.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Prior to installation, protect insulation from exposure to water and from physical damage. Prior to installation, store insulation in manufacturer’s original packaging.

1.11 COORDINATION

A. Coordinate size and location of supports, hangers, and pre-insulated pipe shields/supports specified in Division 15 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.12 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing
heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS, GENERAL REQUIREMENTS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Adhesives used shall be fire resistant in their dry states and UL listed.

2.2 PIPE INSULATION MATERIALS

A. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Armacell LLC; AP Armaflex.
   b. IK Insulation Group; K-Flex USA LLC; Insul-Tube and Insul-Sheet.

B. Glass-Fiber, Preformed Pipe Insulation, Type I:

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Johns Manville; Micro-Lok.
   b. Knauf Insulation; 1000 Pipe Insulation.
   c. Manson Insulation Inc.; Alley-K.
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION  171745   JANUARY 15, 2018

2. Type I, 850 deg F Materials: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

2.3 DUCTWORK INSULATION MATERIALS

A. Blanket Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the products specified.

   a. CertainTeed Corp.; Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Duct Wrap.
   d. Manson Insulation Inc.; Alley Wrap FSK.
   e. Owens Corning; All-Service Duct Wrap.

B. Board Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the products specified.

   a. CertainTeed Corp.; Commercial Board.
   b. Fibrex Insulations Inc.; FBX.
   c. Johns Manville; 800 Series Spin-Glas.
   d. Knauf Insulation; Insulation Board.
   e. Manson Insulation Inc.; AK Board.
   f. Owens Corning; Fiberglas 700 Series.

C. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Armacell LLC; AP Armaflex.
   b. IK Insulation Group; K-Flex USA LLC; Insul-Sheet.

2.4 EQUIPMENT INSULATION MATERIALS

A. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Armacell LLC; AP Armaflex.
   b. IK Insulation Group; K-Flex USA LLC; Insul-Sheet and Insul-Tube.

B. Board Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. CertainTeed Corp.; Commercial Board.
   b. Fibrex Insulations Inc.; FBX.
   c. Johns Manville; 800 Series Spin-Glas.
   d. Knauf Insulation; Insulation Board.
   e. Manson Insulation Inc.; AK Board.
   f. Owens Corning; Fiberglas 700 Series.

2.5 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested according to ASTM E2336.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Thermal Ceramics; FireMaster FastWrap XL and Pyroscat XL.
2.6 INSULATING CEMENTS

   1. Products: Subject to compliance with requirements, provide one of the products specified.
      a. Insulco, Division of MFS, Inc.; Triple I.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
   1. Products: Subject to compliance with requirements, provide one of the products specified.

2.7 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to it and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   1. Products: Subject to compliance with requirements, provide one of the products specified.
      a. Armacell LCC; 520 Adhesive.
      b. Foster Products Corporation, H. B. Fuller Company; 85-75.
      c. RBX Corporation; Rubatex Contact Adhesive.

   1. Products: Subject to compliance with requirements, provide one of the products specified.
a. Childers Products, H.B. Fuller Company; CP-82.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the products specified.

a. Dow Chemical Company (The); 739, Dow Silicone.
e. Speedline Corporation; Speedline Vinyl Adhesive.

2.8 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the products specified.

b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.


C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   b. Foster Products Corporation, H. B. Fuller Company; 35-00.
   c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
   e. Mon-Eco Industries, Inc.; 55-50.
   f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.

3. Service Temperature Range: Minus 20 to plus 200 deg F.

4. Solids Content: 63 percent by volume and 73 percent by weight.


2.9 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the products specified.
   b. Foster Products Corporation, H. B. Fuller Company; 95-44.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.

5. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Childers Products, H.B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.

C. Joint Sealants for Cellular-Glass, Phenolic-Foam, and Polyisocyanurate:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
      a. Childers Products, H.B. Fuller Company; CP-76.
      b. Foster Products Corporation, H. B. Fuller Company; 30-45.
      c. Marathon Industries, Inc.; 405.
      d. Mon-Eco Industries, Inc.; 44-05.
      e. Pittsburgh Corning Corporation; Pittseal 444.
      f. Vimasco Corporation; 750.
   2. Materials shall be compatible with insulation materials, jackets, and substrates.
   3. Permanently flexible, elastomeric sealant.
   4. Service Temperature Range: Minus 100 to plus 300 deg F.
   5. Color: White or gray.

2.10 FACTORY-APPLIED JACKETS

A. Insulation systems indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.11 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as specified; roll stock ready for shop or field cutting and forming.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Johns Manville; Zeston and Ceel-Co.
   c. Proto PVC Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.


4. Factory-fabricated tank heads and tank side panels.

D. PVC Fitting Covers: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C, and including flexible glass fiber insulation inserts.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Johns Manville; Zeston and Ceel-Co.
   c. Proto PVC Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by manufacturer.


4. Factory-fabricated fitting covers:
a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, and mechanical joints.

E. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. PABCO-Childers Metals; ITW Insulation Systems; Metal Jacketing Systems.
   b. RPR Products, Inc.; Insul-Mate.

   a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
   b. Finish and thickness are indicated in field-applied jacket schedules.
   d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper or 2.5-mil-thick Polysurlyn.
   e. Factory-Fabricated Fitting Covers:
      1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      2) Provide factory fabricated PVC tee covers, flange and union covers, beveled collars and valve covers.
      3) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.


1. Products: Subject to compliance with requirements, provide one of the products specified.
G. Self-Adhesive Outdoor Jacket for Ductwork: Laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with aluminum-foil facing.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. MFM Building Products Corp.; FlexClad-400
   b. Polyguard; Alumaguard.
   c. Venture Tape Corp.; VentureClad.

H. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Dow Chemical Company (The), Saran 540 Vapor Retarder Film.

I. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Dow Chemical Company (The), Saran 560 Vapor Retarder Film.

2.12 REMOVABLE AND REUSABLE INSULATION COVERS

A. Flexible Style: Custom fabricated composite jackets for valves, flanges, and expansion joints consisting of 4 inches of high temperature fiberglass insulation compressed between Teflon impregnated fiberglass inner and
outer facing stitched with fiberglass core Teflon thread, and secured with Velcro fasteners and double D-ring cinching. Service temperature range of minus 40 deg F to 500 deg F.

1. Fabricators:
   a. Apex Energy & Environmental Products Inc.
   b. 3i Supply Co.; K-Tex.
   c. Valley Group of Companies.

B. Rigid Style: Custom fabricated composite jackets for valves, flanges, and expansion joints consisting of rigid foam insulation with silicone impregnated fiberglass outer facing stitched with fiberglass thread, and secured with Velcro fasteners and double D-ring cinching. Service temperature range of minus 40 deg F to 500 deg F.

1. Fabricators:
   a. Valley Group of Companies.

2.13 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Products: Subject to compliance with requirements, provide one of the products specified.

   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
   b. Compac Corp.; 104 and 105.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   b. Compac Corp.; 110 and 111.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
   d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
   b. Compac Corp.; 130.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
   d. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.
1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   b. Compac Corp.; 120.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.

2. Width: 3 inches.
3. Film Thickness: 4 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Dow Chemical Company (The); Saran 560 Vapor Retarder Tape.

2. Width: 3 inches.
3. Film Thickness: 6 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.
2.14 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. PABCO-Childers Metals; ITW Insulation Systems; Pab-Bands and Fabstraps.
   b. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing or closed seal.

3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.


B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
   a. Products: Subject to compliance with requirements, provide one of the products specified.
      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; CD.
      3) Midwest Fasteners, Inc.; CD.
      4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
   a. Products: Subject to compliance with requirements, provide one of the products specified.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the products specified.

1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the products specified.

1) GEMCO; Nylon Hangers.
2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the products specified.

1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
2) GEMCO; Press and Peel.
3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, provide one of the products specified.

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturers:
   1) GEMCO.
   2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

   1. Manufacturers:
      a. ACS Industries, Inc.
      b. C & F Wire.
      c. PABCO-Childers Metals; ITW Insulation Systems.
      d. RPR Products, Inc.

2.15 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or 316.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
   1. Verify that systems and equipment to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
   1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
   2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that applies to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.
3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at the 4 o’clock or 8 o’clock position on horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive as recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

   1. Install insulation continuously through hangers and around anchor attachments.

   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install thermal hanger insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover thermal hanger inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at the 4 o’clock or 8 o’clock position on the pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness. Where compression of insulation is possible, fabricate/install insulation per manufacturer’s recommendations.
N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with
joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations that Are Not Fire Rated: Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations:

1. Terminate ductwork insulation at angle closure of fire damper sleeves.

2. Install pipe insulation continuously through penetrations of fire-rated walls and partitions.

   a. Firestopping is specified in Division 07 Section “Through-Penetration Firestop Systems.”

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at angle closure of fire damper sleeves.

2. Pipe: Install insulation continuously through floor penetrations.

   a. Seal penetrations through fire-rated assemblies according to Division 07 Section "Through-Penetration Firestop Systems."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible Elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire.
Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

E. Install removable and reusable insulation covers in accordance with fabricator’s instructions, and at the following locations:

1. At valves, flanges, and expansion joints. Expansion joints shall have jacket installed in a manner to allow for replacing of joints without removing insulation cover.

3.6 FLEXIBLE ELASTOMERIC PIPE INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 GLASS-FIBER AND MINERAL WOOL PIPE INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install PVC fitting covers when available.
2. When PVC fitting covers are not available, install preformed pipe insulation to outer diameter of pipe flange:
a. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

b. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with fiberglass or mineral wool blanket insulation as specified for system.

3. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install PVC fitting covers when available.
2. When PVC fitting covers are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install PVC fitting covers when available.
2. When PVC fitting covers are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 DUCT AND PLENUM INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions. Adhesive may be omitted from top surface of horizontal rectangular ducts.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not over compress insulation during installation.

e. Impale insulation over pins and attach speed washers.

f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints,
secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

   d. Do not over compress insulation during installation.

   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

C. Flexible Elastomeric Thermal Insulation Installation for Ducts and Plenums: Install insulation over entire surface of ducts and plenums.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.
3. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with strips of same material used to insulate duct and following manufacturer’s installation instructions.
3.9 DUCT LAGGING INSTALLATION

A. Install between silencers and shaft or Mechanical Equipment Room walls, and where indicated on Drawings.

B. Ensure sufficient clearance between ductwork to be lagged and adjacent items.

C. Install lagging as detailed on Drawings.

D. Adhere board insulation with adhesive. Do not use pins.

E. Install gypsum board layers. Stagger joints between layers. Seal joints with acoustical sealant.

3.10 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.

2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.

3. Protect exposed corners with secured corner angles.

4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

   a. Do not weld anchor pins to ASME-labeled pressure vessels.

   b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.

   c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.

   d. Do not over compress insulation during installation.

   e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.

   f. Impale insulation over anchor pins and attach speed washers.
g. 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.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.

6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.

7. Stagger joints between insulation layers at least 3 inches.

8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.

9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.

10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.

2. Seal longitudinal seams and end joints.
C. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.

2. Fabricate boxes from galvanized steel, at least 0.040 inch thick.

3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

C. Where FSK jackets are indicated, install as follows:

   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch 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-barrier mastic.
D. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

E. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

F. Where self-adhesive jackets are indicated, install according to manufacturer’s instructions and details on the drawings. Overlap seams arranged to shed water.

G. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.

2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.

3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.

4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch circumference limit allows for 2-inch overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use
adhesive on the lap seal. Visually inspect lap seal for "fish mouthing," and use PVDC tape along lap seal to secure joint.

5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.12 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, install two layers in strict accordance with manufacturer’s instructions, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors in strict accordance with insulation manufacturer’s to achieve same fire rating as duct.

C. Maintain a copy of insulation manufacturer’s installation instructions on site for Code Official.

D. Where fire-rated plenum wrap system is indicated, secure to system piping to maintain a continuous UL-listed fire rating.

E. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Through-Penetration Firestop Systems."

3.13 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system specified in Division 09 painting Sections.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
D. Do not field paint aluminum or stainless-steel jackets.

END OF SECTION 15080
SECTION 15110 - GENERAL DUTY VALVES FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 02 piping Sections for general-duty and specialty valves for site construction piping.
2. Division 15 fire-suppression piping and fire pump Sections for fire-protection valves.
3. Division 15 Section "Mechanical Identification" for valve tags and charts.
4. Division 15 piping Sections for specialty valves applicable to those Sections only.
5. Division 15 Section “General-Duty Valves for HVAC” for HVAC valves.
6. Division 15 Section "Temperature Controls" for control valves and actuators.

1.2 SUMMARY

A. This Section includes valves for general plumbing applications. Refer to piping Sections for specialty valve applications.

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. NRS: Nonrising stem.
5. OS&Y: Outside screw and yoke.
6. PTFE: Polytetrafluoroethylene plastic.
7. RPTFE: Reinforced polytetrafluoroethylene plastic.
8. SWP: Steam working pressure.
9. TFE: Tetrafluoroethylene plastic.
10. WOG: Water, oil, and gas.

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. Certification that products for use in potable water systems comply with NSF 61 and NSF 372.
1.5 QUALITY ASSURANCE

A. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.

C. NSF Compliance: NSF 61 and NSF 372 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 VALVES, GENERAL

A. Isolation valves are scheduled on the Drawings. For other general plumbing valve applications, 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; and bronze lift check valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. 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.

D. For valves not indicated in the Application Schedules, select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for condenser water, heating hot water, steam, and steam condensate services.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged, solder-joint, or threaded ends.
3. For Copper Tubing, NPS 5 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 5 and Larger: Flanged ends.
7. For Grooved-End Systems: Valve ends may be grooved.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted unless otherwise noted. Wetted surfaces of valves contacted by consumable water shall contain not more than 0.25 percent weighted average lead content.

1. Exceptions:
   a. Valves in pumped sanitary systems.
   b. Valves in pumped storm systems.
   c. Drain valves.
   d. Valves in general air or vacuum systems.
   e. Valves in irrigation systems.
   f. Valves in non-potable water systems.
   g. Valves in other plumbing systems not intended for human consumption.
F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

G. 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 Operator: For quarter-turn valves NPS 8 and larger.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6 and smaller.

H. Extended Valve Stems: On insulated valves.


J. Valve Grooved Ends: AWWA C606.

K. Solder Joint: With sockets according to ASME B16.18.

1. Caution: Disassemble valves when soldering, as recommended by the manufacturer, to prevent damage to internal parts.

L. Threaded: With threads according to ASME B1.20.1.

M. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Bronze Ball Valves, General: MSS SP-110 and have bronze body complying with ASTM B 584, except for Class 250 which shall comply with ASTM B 61, full-depth ASME B1.20.1 threaded or solder ends, and blowout-proof stems.

B. Two-Piece, Regular Port Bronze Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel ball and stem, reinforced TFE seats, blow-out-proof stem, with adjustable stem packing, soldered or threaded ends; and 150 psig SWP and 600-psig CWP ratings.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; by Conbraco Industries, Inc.; Series 70LF-140/240.
   b. Hammond Valve.
   c. Milwaukee Valve Company; Model UPBA100S/150S.
   d. NIBCO INC.; Models S-580-70-66-LF/T-580-70-66-LF.
   e. Watts Water Technologies, Inc.

2.3 GENERAL SERVICE BUTTERFLY VALVES

A. General: MSS SP-67, for bubble-tight shutoff, extended-neck for insulation, disc and lining suitable for potable water, unless otherwise indicated, and with the following features:

   1. Full lug, and grooved valves shall be suitable for bidirectional dead end service at full rated pressure without the use or need of a downstream flange.
   2. Valve sizes NPS 2 through NPS 6 shall have lever lock operator; valve sizes NPS 8 and larger shall have weatherproof gear operator.


   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Apollo Valves; by Conbraco Industries, Inc.; Series 143 and Series LD145.
      b. Bray International, Inc.
      c. DeZurik.
      d. Forum Energy Technologies; ABZ Valve.
      e. Hammond Valve.
      f. Milwaukee Valve Company.
      g. NIBCO INC.; LD-2000-3/5.
      h. Pentair Valves & Controls; Keystone.
i. Tyco Flow Control; Grinnell Flow Control.

j. Watts Water Technologies.

C. Grooved-End Butterfly Valves with EPDM-Encapsulated Ductile-Iron Disc: Ductile-iron body with grooved or shouldered ends and polyamide coating inside and outside; Type 416 stainless-steel stem, PTFE bronze sintered on steel bushing, and 300-psig CWP Rating for Valves NPS 2 through NPS 8, 200 psig CWP Rating for Valves NPS 10 through NPS 12.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International, Inc.
   b. NIBCO INC.; Model GD-4765-3/5.
   c. Tyco Fire & Building Products; Grinnell Mechanical Products.
   d. Victaulic Co. of America.

2.4 BRONZE CHECK VALVES

A. Bronze Check Valves, General: MSS SP-80.

B. Class 125, Bronze, Swing Check Valves with Bronze Disc: ASTM B-62 bronze body and seat with regrinding-type bronze disc, Y-pattern design, soldered or threaded end connections, and having 200 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   b. Milwaukee Valve Company; Model UP509/UP1509.
   c. NIBCO INC.; Models S-413-B-LF or T-413-B-LF.
   d. Watts Water Technologies; LFCVY/LFCVYS.

2.5 IRON SWING CHECK VALVES

B. Class 125, Gray-Iron, Standard Swing Check Valves: ASTM A-126, Class B cast-iron body and bolted bonnet with flanged end connections; non-asbestos synthetic-fiber gaskets; bronze disc and seat; and having 200 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; by Conbraco Industries, Inc.; Model 910F.
   b. Crane Co.; Crane Valves.
   c. Crane Co.; Stockham Div.
   d. Hammond Valve; IR1124-HI.
   e. Milwaukee Valve Company; Model F-2974.
   f. NIBCO INC.; Model F-918-B.
   g. Watts Water Technologies.

C. Class 250, Gray-Iron, Swing Check Valves: ASTM A-126, Class B cast-iron body and bolted bonnet with flanged end connections; non-asbestos synthetic-fiber gaskets; and bronze disc and seat; and having 500 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; by Conbraco Industries, Inc.; Model 920F.
   b. Crane Co.; Crane Valves.
   c. Crane Co.; Stockham Div.
   d. Hammond Valve; IR322.
   e. Milwaukee Valve Company; Model F-2970.
   f. NIBCO INC.; Model F-968-B.
   g. Watts Water Technologies.

D. Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends; nonasbestos, synthetic-fiber gaskets; rubber seats; and having 250-psig CWP Rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Mueller Co.
   b. NIBCO, INC.; Model G-917-W.
c. Tyco Fire & Building Products; Grinnell Mechanical Products.

d. Victaulic Co. of America.

2.6 LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Nonmetallic TFE Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; by Conbraco Industries, Inc.; Model CBV-LF (61LF Series).
   b. Hammond Valve; UP943 and UP947.
   c. Milwaukee Valve Company; UP548T and UP1548T.
   d. NIBCO INC.; Model S-480-Y-LF and T-480-Y-LF.
   e. Watts Water Technologies; LF600.

2. Description:

   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 250 psig.
   d. Body Material: Lead free brass or bronze.
   e. Ends: Threaded or Solder.
   f. Disc: PTFE, or TFE.

2.7 SPRING-LOADED, CENTER-GUIDED LIFT-DISC (SILENT) CHECK VALVES

A. Lift-Disc Check Valves, General: FCI 74-1 and MIL-V-18436F, with spring-loaded, center-guided bronze disc and seat.

B. Class 125, Wafer, Lift-Disc Check Valves: Wafer style with cast-iron body with diameter made to fit within bolt circle, and having 200 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. NIBCO INC.; Model W-910-B-LF.
b. Mueller Steam Specialty.
c. Milwaukee Valve Company.
d. Hammond Valve.

C. Class 250, Wafer, Lift-Disc Check Valves: Wafer style with cast-iron body with diameter made to fit within bolt circle, and having 400 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. NIBCO INC.; Model W-960-B-LF.
b. Mueller Steam Specialty.
c. Milwaukee Valve Company.
d. Hammond Valve.

D. Class 125, Globe, Flanged Lift-Disc Check Valves: Globe style with cast-iron body and flanged ends, and having 200 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. NIBCO INC.; Model F-910-B-LF.
b. Mueller Steam Specialty.
c. Milwaukee Valve Company.
d. Hammond Valve.

E. Class 250, Globe, Flanged Lift-Disc Check Valves: Globe style with cast-iron body and flanged ends, and having 400 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. NIBCO INC.; Model F-960-B-LF.
b. Mueller Steam Specialty.
c. Milwaukee Valve Company.
d. Hammond Valve.
2.8 BRONZE GLOBE VALVES

A. Bronze Globe Valves, General: MSS SP-80, with malleable-iron handwheel.

B. Class 125, TFE Disc, Bronze Globe Valves: ASTM B-62 bronze body, bonnet, and seat, TFE disc, copper-silicone bronze stem, union-ring bonnet, soldered or threaded end connections; and having 200 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; by Conbraco Industries, Inc.; Model 121T-LF.
   b. Hammond Valve; UP418 and UP440.
   c. Milwaukee Valve Company; Model UP502 and UP1502.
   d. Watts Water Technologies, Inc.; LFGLV.

2.9 CAST-IRON ANGLE VALVES

A. Cast-Iron Angle Valves, General: MSS SP-85, Type II; having ASTM A 126, Class B cast-iron body and bolted bonnet; bronze mounted, non-asbestos packing and gaskets; and flanged-end connections.

B. Class 125, Cast-Iron, Standard Angle Valves: 200-psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. NIBCO INC.; Model F-818-B.
   b. Crane Co.; Stockham Valves.
   c. Crane Co.; Crane Valves.

2.10 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Bronze ball valve as specified in this Section. Lead free construction is not required.
2. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.11 SOURCE QUALITY CONTROL

A. Identification: Factory label or color coding to identify lead free valves.

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 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. Butterfly valves shall be installed with stem horizontal to allow support for the disc and the cleaning action of the disc.

E. Install valves in position to allow full stem movement.

F. 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.

3.3 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.4 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 15110
SECTION 15112 - GENERAL DUTY VALVES 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.

B. Related Sections include the following:

1. Division 02 piping Sections for general-duty and specialty valves for site construction piping.
2. Division 15 fire-suppression piping and fire pump Sections for fire-protection valves.
3. Division 15 Section "Mechanical Identification" for valve tags and charts.
4. Division 15 Section "General-Duty Valves for Plumbing" for plumbing valves.
5. Division 15 Section "Temperature Controls" for control valves and actuators.

1.2 SUMMARY

A. This Section includes valves for general HVAC applications. Refer to piping Sections for specialty valve applications.

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. NRS: Nonrising stem.
5. OS&Y: Outside screw and yoke.
6. PTFE: Polytetrafluoroethylene plastic.
7. RPTFE: Reinforced polytetrafluoroethylene plastic.
8. SWP: Steam working pressure.
9. TFE: Tetrafluoroethylene plastic.
10. WOG: Water, oil, and gas.

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 B31.9 for building services piping valves.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

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 VALVES, GENERAL

A. Isolation valves are scheduled on the Drawings. For other general HVAC valve applications, 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; and bronze lift check valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. 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.

D. For valves not indicated in the Application Schedules, select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for condenser water, heating hot water, steam, and steam condensate services.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged, solder-joint, or threaded ends.
3. For Copper Tubing, NPS 5 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 5 and Larger: Flanged ends.
7. For Grooved-End Systems: Valve ends may be grooved. Do not use for steam or steam condensate piping.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

G. 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 Operator: For quarter-turn valves NPS 8 and larger.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6 and smaller.

H. Extended Valve Stems: On insulated valves.

J. Valve Grooved Ends: AWWA C606.

K. Solder Joint: With sockets according to ASME B16.18.
   1. Caution: Disassemble valves when soldering, as recommended by the manufacturer, to prevent damage to internal parts.

L. Threaded: With threads according to ASME B1.20.1.

M. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Bronze Ball Valves, General: MSS SP-110 and have bronze body complying with ASTM B 584, except for Class 250 which shall comply with ASTM B 61, full-depth ASME B1.20.1 threaded or solder ends, and blowout-proof stems.

B. Two-Piece, Regular Port Bronze Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel ball and stem, reinforced TFE seats, blow-out-proof stem, with adjustable stem packing, soldered or threaded ends; and 150 psig SWP and 600-psig CWP ratings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; by Conbraco Industries, Inc.; Series 70-140.
   b. Crane Co.; Crane Valves.
   c. Hammond Valve.
   d. Milwaukee Valve Company; Model BA100S.
   e. NIBCO INC.; Models S-580-70-66 or T-580-70-66.
   f. Watts Water Technologies, Inc.

2.3 GENERAL SERVICE BUTTERFLY VALVES

A. General: MSS SP-67, for bubble-tight shutoff, extended-neck for insulation, disc and lining suitable for potable
water, unless otherwise indicated, and with the following features:

1. Full lug, and grooved valves shall be suitable for bi-directional dead end service at full rated pressure without the use or need of a downstream flange.

2. Valve sizes NPS 2 through NPS 6 shall have lever lock operator; valve sizes NPS 8 and larger shall have weatherproof gear operator.


1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; by Conbraco Industries, Inc.; Series 143 and Series LD 145.
   b. Bray International, Inc.
   c. DeZurik.
   d. Forum Energy Technologies; ABZ Valve.
   e. Hammond Valve.
   f. Milwaukee Valve Company.
   g. NIBCO INC.; LD-2000-3/5.
   h. Pentair Valves & Controls; Keystone.
   i. Tyco Flow Control; Grinnell Flow Control.
   j. Watts Water Technologies.

C. Grooved-End Butterfly Valves with EPDM-Encapsulated Ductile-Iron Disc: Ductile-iron body with grooved orshouldered ends and polyamide coating inside and outside; Type 416 stainless-steel stem, PTFE bronze sintered on steel bushing, and 300-psig CWP Rating for Valves NPS 2 through NPS 8, 200 psig CWP Rating for Valves NPS 10 through NPS 12.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International, Inc.
b. NIBCO INC.; Model GD-4765-3/5.
c. Tyco Fire & Building Products; Grinnell Mechanical Products.
d. Victaulic Co. of America.

2.4 BRONZE CHECK VALVES

A. Bronze Check Valves, General: MSS SP-80.

B. Class 150, Bronze, Swing Check Valves with Bronze Disc: ASTM B-62 bronze body and seat with regrinding-type bronze disc, Y-pattern design, soldered or threaded end connections, and having 300 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; by Conbraco Industries, Inc.
   b. Crane Co.; Crane Valves.
   c. Crane Co.; Stockham Div.
   d. Hammond Valve.
   e. Milwaukee Valve Company; Model 515.
   f. NIBCO INC.; Models S-433-B or T-433-B.
   g. Watts Water Technologies.

2.5 IRON SWING CHECK VALVES


B. Class 125, Gray-Iron, Standard Swing Check Valves: ASTM A-126, Class B cast-iron body and bolted bonnet with flanged end connections; non-asbestos synthetic-fiber gaskets; bronze disc and seat; and having 200 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; by Conbraco Industries, Inc.
   b. Crane Co.; Crane Valves.
   c. Crane Co.; Stockham Div.
   d. Hammond Valve.
   e. Milwaukee Valve Company; Model F-2974.
C. Class 250, Gray-Iron, Swing Check Valves: ASTM A-126, Class B cast-iron body and bolted bonnet with flanged end connections; non-asbestos synthetic-fiber gaskets; and bronze disc and seat; and having 500 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; by Conbraco Industries, Inc.
   b. Crane Co.; Crane Valves.
   c. Crane Co.; Stockham Div.
   d. Hammond Valve.
   e. Milwaukee Valve Company; Model F-2970.
   f. NIBCO INC.; Model F-968-B.
   g. Watts Water Technologies.

D. Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends; nonasbestos, synthetic-fiber gaskets; rubber seats; and having 250-psig CWP Rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Mueller Co.
   b. NIBCO, INC.; Model G-917-W.
   c. Tyco Fire & Building Products; Grinnell Mechanical Products.
   d. Victaulic Co. of America.

2.6 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Nonmetallic TFE Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Hammond Valve.
   b. Milwaukee Valve Company.
   c. NIBCO INC.; Model S-480-Y or T-480-Y.
2. Description:

   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 250 psig.
   e. Ends: Threaded or Solder.
   f. Disc: PTFE, or TFE.

2.7 SPRING-LOADED, CENTER-GUIDED LIFT-DISC (SILENT) CHECK VALVES

A. Lift-Disc Check Valves, General: FCI 74-1 and MIL-V-18436F, with spring-loaded, center-guided bronze disc and seat.

B. Class 125, Wafer, Lift-Disc Check Valves: Wafer style with cast-iron body with diameter made to fit within bolt circle, and having 200 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. NIBCO INC.; Model W-910-B.
   b. Mueller Steam Specialty.
   c. Milwaukee Valve Company.
   d. Hammond Valve.

C. Class 250, Wafer, Lift-Disc Check Valves: Wafer style with cast-iron body with diameter made to fit within bolt circle, and having 400 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. NIBCO INC.; Model W-960-B.
   b. Mueller Steam Specialty.
   c. Milwaukee Valve Company.
   d. Hammond Valve.
D. Class 125, Globe, Flanged Lift-Disc Check Valves: Globe style with cast-iron body and flanged ends, and having 200 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. NIBCO INC.; Model F-910-B.
   b. Mueller Steam Specialty.
   c. Milwaukee Valve Company.
   d. Hammond Valve.

E. Class 250, Globe, Flanged Lift-Disc Check Valves: Globe style with cast-iron body and flanged ends, and having 400 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. NIBCO INC.; Model F-960-B.
   b. Mueller Steam Specialty.
   c. Milwaukee Valve Company.
   d. Hammond Valve.

2.8 BRONZE GLOBE VALVES

A. Bronze Globe Valves, General: MSS SP-80, with malleable-iron handwheel.

B. Class 150, TFE Disc, Bronze Globe Valves: ASTM B-62 bronze body, bonnet, and seat, TFE disc, copper-silicone bronze stem, union-ring bonnet, soldered or threaded end connections; and having 300 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; by Conbraco Industries, Inc.
   b. Crane Co.; Crane Valves.
   c. Hammond Valve.
   d. Milwaukee Valve Company; Model 590.
   e. NIBCO INC.; Models S-235-Y or T-235-Y.
2.9 CAST-IRON GLOBE VALVES

A. Cast-Iron Globe Valves, General: MSS SP-85 with bolted bonnet, flanged end connections, and non-asbestos packing and gasket.

B. Class 125, Metal Seat, Cast-Iron Globe Valves: ASTM A-126, Class B cast-iron body and bonnet with bronze trim and having 200 psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; by Conbraco Industries, Inc.
   b. Crane Co.; Crane Valves.
   c. Crane Co.; Stockham Valves.
   d. Hammond Valve.
   e. Milwaukee Valve Company; Model F-2981.
   f. NIBCO INC.; Model F-718-B.
   g. Watts Water Technologies, Inc.

2.10 BRONZE ANGLE VALVES

A. Bronze Angle Valves, General: MSS SP-80, with silicon bronze stem, non-asbestos packing and malleable-iron handwheel.

B. Class 150, Bronze Angle Valves: ASTM B 62 bronze body with TFE disc, union-ring bonnet, threaded ends, and having 300-psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Crane Co.; Crane Valves.
   b. Crane Co.; Stockham Valves.
   c. Hammond Valve.
   d. Milwaukee Valve Company; Model 595T.
   e. NIBCO INC.; Model T-335-Y.
   f. The Wm. Powell Company.
2.11 CAST-IRON ANGLE VALVES

A. Cast-Iron Angle Valves, General: MSS SP-85, Type II; having ASTM A 126, Class B cast-iron body and bolted bonnet; bronze mounted, non-asbestos packing and gaskets; and flanged-end connections.

B. Class 125, Cast-Iron, Standard Angle Valves: 200-psig CWP rating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. NIBCO INC.; Model F-818-B.
   b. Crane Co.; Stockham Valves.
   c. Crane Co.; Crane Valves.

2.12 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Bronze ball valve as specified in this Section.
2. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.13 CHAINWHEEL ACTUATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries, Inc.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.
2. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
3. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.
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.

G. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

H. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

I. Locate valves for easy access and provide separate support where necessary.

J. Install valves in horizontal piping with stem at or above center of pipe. Butterfly valves shall be installed with
stem horizontal to allow support for the disc and the cleaning action of the disc.

K. Install valves in position to allow full stem movement.

L. Install chainwheel operators on valves NPS 4 and larger and more than 84 inches above floor. Extend chains to 60 inches above finished floor elevation.

M. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Lift Check Valves: With stem upright and plumb.

3.2 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 15112
SECTION 15122 - METERS AND GAGES

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.

B. Related Sections include the following:

1. Division 15 Section “Mechanical General Requirements.”
2. Division 15 Section “Basic Mechanical Materials and Methods.”
3. Division 15 Section "Fuel Gas Piping" for gas utility meters.

1.2 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. FPR: Fiberglass reinforced plastic.
1.3 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.

B. Comply with NSF 61, "Drinking Water System Components – Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components – Lead Content for potable domestic water piping and components.

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 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers:

1. AMETEK, Inc.; U.S. Gauge Div.
3. REOTEMP Instrument Corporation.
4. Trerice, H. O. Co.
5. Weiss Instruments, Inc.
6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
B. Case: Die-cast aluminum or Chrome-plated brass, 9 inches long.

C. Tube: Red, blue, or green reading, organic-liquid filled, with magnifying lens.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Window: Glass or plastic.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer. Brass for compatible services less than 353 degrees F (178 degrees C); ANSI 18-8 stainless steel for all others to suit service. Furnish extension neck to accommodate insulation where applicable.

2.4 PRESSURE GAGES

A. Manufacturers:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Cambridge.
3. Dwyer Instruments, Inc.
5. Miljoco Corporation.
6. Trerice, H. O. Co.
7. Weiss Instruments, Inc.
8. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Stainless steel, aluminum, or FRP, 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Pointer: Red or other dark-color metal.
7. Window: Glass or plastic.
8. Ring: Stainless steel or chrome plated metal.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Water: 0–100 PSIG (1 psi divisions to 50 psi; 5 psi divisions above 50 psi), liquid filled.
12. Steam (15 psig and less): 30 inches Hg vacuum–30 PSIG (1 inch divisions below 0 psi; 1 psi divisions above 0 psi), silicone dampened.
13. Steam (16 to 60 psig): 30 inches Hg vacuum–100 PSIG, silicone dampened.
14. Range for Fluids under Pressure: 1-1/2 times expected working pressure. If not a standard scale, select next largest scale.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass ball type.
2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.5 TEST PLUGS

A. Manufacturers:

1. Peterson Equipment Co., Inc.
B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F for cold services, and 500 psig at 275 deg F for hot services.

D. Core Inserts: One or two self-sealing rubber valves.
   1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be Neoprene.
   2. Insert material for air or water service at minus 30 to plus 275 deg F shall be Nordel.

E. Test Kit: Furnish test kit(s) containing one pressure gage and adaptor, thermometer(s), and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.
   1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be 0 to 200 psig.
   2. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.
   3. Carrying case shall have formed instrument padding.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install liquid-in-glass thermometers in the following locations:
   1. Inlet and outlet of each hydronic zone.
   2. Inlet and outlet of each hydronic boiler and chiller.
   3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
   4. Inlet and outlet of each hydronic heat exchanger.
   5. Inlet and outlet of each hydronic heat-recovery unit.
   6. Inlet and outlet of each thermal storage tank.
   7. Outside-air, return-air, and mixed-air ducts.
B. Provide the following temperature ranges for thermometers:

1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.
2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.
3. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
4. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions.
5. Air Ducts: Minus 40 to plus 110 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install dry-case-type pressure gages on inlet and outlet of each pressure-reducing valve.

B. Install liquid-filled-case-type pressure gages at chilled- and condenser-water inlets and outlets of chillers.

C. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.

C. Duct Thermometer Support Flanges: Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.

D. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

E. Install ball valve and snubber fitting in piping for each pressure gage for fluids (except steam).

F. Install ball valve and syphon fitting in piping for each pressure gage for steam.
G. Install test plugs in tees in piping.

3.4 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

B. Ground equipment according to Division 16 Section "Grounding and Bonding."

C. Connect wiring according to Division 16 Section "Conductors and Cables."

3.5 ADJUSTING

A. Calibrate meters according to manufacturer's written instructions, after installation.

B. Adjust faces of meters and gages to proper angle for best visibility.
SECTION 15140 - DOMESTIC WATER PIPING

PART 1 - GENERAL .................................................. 1
  1.1 RELATED DOCUMENTS ......................................... 1
  1.2 SUMMARY ..................................................... 2
  1.3 DEFINITIONS .................................................. 2
  1.4 PERFORMANCE REQUIREMENTS ................................. 2
  1.5 SYSTEMS DESCRIPTION ....................................... 2
  1.6 SUBMITTALS .................................................. 3
  1.7 QUALITY ASSURANCE ......................................... 3
  1.8 PROJECT CONDITIONS ........................................ 3

PART 2 - PRODUCTS ................................................. 4
  2.1 MANUFACTURERS ............................................. 4
  2.2 PIPING MATERIALS ........................................... 4
  2.3 COPPER TUBE AND FITTINGS ................................ 4
  2.4 VALVES ...................................................... 6

PART 3 - EXECUTION ................................................ 6
  3.1 EXCAVATION ................................................... 6
  3.2 PIPING SYSTEM INSTALLATION ............................... 6
  3.3 JOINT CONSTRUCTION ....................................... 7
  3.4 HANGER AND SUPPORT INSTALLATION ....................... 7
  3.5 CONNECTIONS ............................................... 9
  3.6 FIELD QUALITY CONTROL .................................... 10
  3.7 ADJUSTING .................................................. 11
  3.8 CLEANING AND DISINFECTION ............................... 11

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. Related Sections include the following:

  1. Division 02 Section "Water Distribution" for water-service piping outside the building and for water service entrance piping.
  2. Division 15 Section "Mechanical General Requirements."
  3. Division 15 Section "Basic Mechanical Materials and Methods" for materials and methods common to mechanical piping systems.
4. Division 15 Section “Hangers and Supports.”
5. Division 15 Section “Meters and Gages” for thermometers, pressure gages, and fittings.
6. Division 15 Section “Plumbing Valves” for general duty plumbing valves.
7. Division 15 Section “Domestic Water Piping Specialties” for water distribution piping specialties.

1.2 SUMMARY

A. This Section includes domestic water piping inside the building.

1.3 DEFINITIONS

A. PEX: Crosslinked polyethylene plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Where not indicated on the Drawings, provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

1. Exception: PEX plastic piping insert fittings specified are limited to 100 psig.

1.5 SYSTEMS DESCRIPTION

A. Potable and non-potable domestic water piping system materials are scheduled on the Drawing.

B. Refer to Application Schedules on the Drawings for valve types to be used. Where specific valve types are not indicated, the following requirements apply:

2. Drain Duty: Hose-end drain valves.
3. Isolation Valves at Domestic Water Meters: Gate Valves, NPS 2 and Smaller: Class 150, bronze.
4. Isolation Valves at Domestic Water Meters: Gate Valves, NPS 2-1/2 and Larger: Class 125, OS&Y, bronze-mounted cast iron.
C. Transition and special fittings with pressure ratings at least equal to piping rating may be used unless otherwise indicated.

1.6 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.


C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Fire-suppression-water piping.
2. Domestic water piping.
3. HVAC hydronic piping.

D. Field quality-control test reports.

1.7 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.

C. Comply with NSF 61, "Drinking Water System Components – Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components – Lead Content for potable domestic water piping and components.

D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be as recommended by the manufacturer of the grooved components.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then
only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.

2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. 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, Type L, water tube, drawn temper.

2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. 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.

C. Grooved-Joint Systems:

1. Manufacturers:
   b. Tyco Fire & Building Products; Grinnell Mechanical Products; Model 672.
   c. Victaulic Company; Style 606 and Style 607.

2. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

3. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.

D. Copper or Bronze Pressure-Seal Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Viega North America; ProPress System.
   b. NIBCO Inc.; Press System.
   c. Elkhart Products Corporation; an Aalberts Industries Company; Xpress.
   d. Apollo Valves; by Conbraco Industries; ApolloXpress.

2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Maximum 200-psig working-pressure rating at 250 deg F.
E. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube. Mechanically formed tee fittings may be used up to half size of main.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. T-DRILL Industries Inc.

2.4 VALVES

A. General-duty plumbing valves; and drain valves are specified in Division 15 Section "Plumbing Valves."

B. Balancing valves are specified in Division 15 Section "Domestic Water Piping Specialties."

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavating, trenching, and backfilling are specified in Division 02 Section "Earthwork."

3.2 PIPING SYSTEM INSTALLATION

A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Install sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

C. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 15 Section "Basic Mechanical Materials and Methods."

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Pressure
gages are specified in Division 15 Section "Meters and Gages," and strainers are specified in Division 15 Section "Domestic Water Piping Specialties."

E. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops.

F. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

G. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 15 Section "Domestic Water Piping Specialties."

H. Install domestic water piping level without pitch and plumb.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. PEX Piping Joints: Join according to ASTM F 1807.

3.4 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support devices are specified in Division 15 Section "Hangers and Supports." 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: MSS Type 49, spring cushion rolls, if indicated.

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 15 Section "Hangers and Supports."

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.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

F. Install supports for vertical steel piping every 15 feet.

G. Install hangers for drawn-temper copper tubing with the following maximum horizontal spacing and minimum rod diameters:

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.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

H. Install supports for vertical copper tubing every 10 feet.
I. Soft copper tube: Continuous support using v-shaped plastic pipe channel, maximum hanger spacing 8 feet with 3/8-inch rod.

J. Alternate support for copper tubing NPS 3/4 and smaller: Continuous support using v-shaped plastic pipe channel, maximum hanger spacing 8 feet with 3/8-inch rod.

K. Install hangers for Schedule 10 stainless steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 2: 84 inches with 3/8-inch rod.
   2. NPS 2-1/2: 84 inches with 1/2-inch rod.
   3. NPS 3: 96 inches with 1/2-inch rod.
   4. NPS 4: 10 feet with 5/8-inch rod.
   5. NPS 6: 11 feet with 3/4-inch rod.
   6. NPS 8: 12 feet with 7/8-inch rod.
   7. NPS 10 to NPS 12: 14 feet with 7/8-inch rod.

L. Install supports for vertical Schedule 10 stainless steel piping every 15 feet.

M. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect domestic water piping to existing domestic water distribution piping. Use dielectric fitting if connection dissimilar metals. Refer to Application Schedule on the Drawings and Division 15 Section “Basic Mechanical Materials and Methods” for dielectric fittings.

C. Install piping adjacent to equipment and machines to allow service and maintenance.

D. Connect domestic water piping to the following:
   1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."

3. 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 has been 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 final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass 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. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

4. Cap and subject piping to static water pressure of 150 psig. Isolate test piping and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

3.7 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
   b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.


7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.

8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.8 CLEANING AND DISINFECTION

A. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.
B. 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.

C. Prepare and submit reports of purging and disinfecting activities.

END OF SECTION 15140
SECTION 15145 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
1.2 PERFORMANCE REQUIREMENTS
1.3 SUBMITTALS
1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS
2.2 BACKFLOW PREVENTERS
2.3 BALANCING VALVES
2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES
2.5 STRAINERS FOR DOMESTIC WATER PIPING
2.6 WATER HAMMER ARRESTERS
2.7 AIR VENTS

PART 3 - EXECUTION

3.1 INSTALLATION
3.2 CONNECTIONS
3.3 LABELING AND IDENTIFYING
3.4 FIELD QUALITY CONTROL
3.5 ADJUSTING

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. Related Sections include the following:

1. Division 15 Section “Mechanical General Requirements.”
2. Division 15 Section “Basic Mechanical Materials and Methods.”
3. Division 15 Section "Meters and Gages" for thermometers, pressure gages, and flow meters in domestic water piping.
4. Division 15 Section "Domestic Water Piping" for water meters.
5. Division 15 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.
1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Flow Reports and Settings: For calibrated balancing valves.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.

C. NSF Compliance:


2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

3. Comply with NSF 372, "Drinking Water System Components - Lead Content" for components with wetted surfaces in contact with potable water.

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; Conbraco Industries, Inc.
   b. FEBCO; a Division of Watts Water Technologies, Inc.
   c. Watts Water Technologies, Inc.; Watts Regulator Co.
   d. Zurn Plumbing Products Group; Wilkins Div.

3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; Conbraco Industries, Inc.
   b. FEBCO; a Division of Watts Water Technologies, Inc.
   c. Watts Water Technologies, Inc.; Ames Fire & Waterworks.
   d. Watts Water Technologies, Inc.; Watts Regulator Co.
   e. Zurn Plumbing Products Group; Wilkins Div.

3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
5. Size and Capacity: As indicated on the drawings.
6. Accessories:
   a. Valves: Ball type, on inlet and outlet.

C. Hose-Connection Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; Conbraco Industries, Inc.
   b. MIFAB, Inc.
   c. Watts Water Technologies, Inc.; Watts Regulator Co.
   d. Woodford Manufacturing Company.

3. Body: Bronze or brass, nonremovable, with manual drain.
5. Finish: Chrome or nickel plated.

2.2 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; Conbraco Industries, Inc.
   b. FEBCO; a Division of Watts Water Technologies, Inc.
   c. Watts Water Technologies, Inc.; Watts Regulator Co.
   d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
5. Body: Bronze.
7. Finish: Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; Conbraco Industries, Inc.
b. FEBCO; a Division of Watts Water Technologies, Inc.
c. Watts Water Technologies, Inc.; Ames Fire & Waterworks.
d. Watts Water Technologies, Inc.; Watts Regulator Co.
e. Zurn Plumbing Products Group; Wilkins Div.

3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
5. Size and Capacities: As scheduled on the drawings.
6. Body: Bronze for NPS 2 (DN 50) and smaller; cast-iron or ductile-iron, with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
7. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
   c. Y-Pattern strainer and soft-seated check valve.

C. Double-Check Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; Conbraco Industries, Inc.
   b. FEBCO; a Division of Watts Water Technologies, Inc.
   c. Watts Water Technologies, Inc.; Ames Fire & Waterworks.
   d. Watts Water Technologies, Inc.; Watts Regulator Co.
   e. Zurn Plumbing Products Group; Wilkins Div.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
5. Size and Capacities: As scheduled on the drawings.
6. Body: Bronze for NPS 2 (DN 50) and smaller; cast-iron or ductile-iron, with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
7. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

D. Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; Conbraco Industries, Inc.
   b. FEBCO; a Division of Watts Water Technologies, Inc.
   c. Watts Water Technologies, Inc.; Watts Regulator Co.
   d. Zurn Plumbing Products Group; Wilkins Div.

3. Operation: Continuous-pressure applications.
4. Size: As indicated on the drawings.
5. Body: Bronze with union inlet.

E. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 15, 2018


3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10).

F. Hose-Connection Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; Conbraco Industries, Inc.
   c. Woodford Manufacturing Company.

3. Operation: Up to 10-foot head of water (30-kPa) back pressure.
4. Inlet Size: NPS 1/2 or NPS 3/4 (DN 15 or DN 20).
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm (0.19-L/s) flow.

G. Beverage-Dispensing-Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; Conbraco Industries, Inc.
   c. Zurn Plumbing Products Group; Wilkins Div.

3. Operation: Continuous-pressure applications.
5. Body: Stainless steel or Acetal plastic.
2.3 BALANCING VALVES

A. Calibrated Balancing Valves NPS 1/2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Armstrong Pumps, Inc.
   c. Apollo Valves; by Conbraco Industries, Inc.
   d. Bell & Gossett; Xylem Inc.
   e. Flo Fab Inc.
   f. Flow Design Inc.
   g. Griswold Controls.
   h. NIBCO INC.
   i. IMI Indoor Climate; Tour & Andersson.
   j. Taco, Inc.
   k. Watts Water Technologies, Inc.; Watts Regulator Co.

2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Body: Dezincification resistant brass, or bronze.
4. Minimum Flow Rate: 0.3 gpm.

B. Calibrated Balancing Valves NPS 3/4 to NPS 2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Armstrong Pumps, Inc.
   c. Apollo Valves; by Conbraco Industries, Inc.
   d. Bell & Gossett; Xylem Inc.
   e. Flo Fab Inc.
   f. Flow Design Inc.
   g. Griswold Controls.
   h. NIBCO INC.
   i. IMI Indoor Climate; Tour & Andersson.
   j. Taco, Inc.
   k. Watts Water Technologies, Inc.; Watts Regulator Co.
2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Body: Dezincification resistant brass, or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.

C. Calibrated Balancing Valves NPS 2-1/2 to NPS 4:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Bell & Gossett; Xylem Inc.
   c. Flo Fab Inc.
   d.Flow Design Inc.
   e. Griswold Controls.
   f. NIBCO INC.
   g. IMI Indoor Climate; Tour & Andersson.
   h. Watts Water Technologies, Inc.; Watts Regulator Co.

2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2.

D. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; Conbraco Industries, Inc.; Model MVD (34D Series).
   b. Bradley Corporation.
   c. Lawler Manufacturing Company, Inc.
   d. Leonard Valve Company; Series 170-LF and 270-LF.
   e. Watts Water Technologies, Inc.; Powers Division; Hydroguard Series e480 and LM495.
g. Zurn Plumbing Products Group; Wilkins Div.

4. Type: Thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
8. Outlet Temperature Range: Adjustable from 85 deg F to 120 deg F. Set at 105 deg F.
9. Minimum Flow Rate: 0.5 gpm.
10. Valve Finish: Rough bronze.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Manufacturers:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Keckley.
   c. Metraflex.
   d. Mueller Steam Specialty.
   e. NIBCO, Inc.
   f. Spence.
   g. SSI Equipment, Inc.
   h. Watts Water Technologies, Inc.
   i. Yarway.

2. CWP: 200 psig minimum, unless otherwise indicated.
3. SWP: 125 psig minimum, unless otherwise indicated.
4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
5. End Connections: Threaded or soldered for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
6. Screen: Stainless steel with round perforations, unless otherwise indicated.
7. Perforation Size:

   a. Strainers NPS 2 and Smaller: 0.033 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
c. Strainers NPS 5 and Larger: 0.045 inch.


2.6 WATER HAMMER ARRESTERS

A. Water Hammer Arresters (Copper Tube Type):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. MIFAB, Inc.
   b. PPP Inc.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.

3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.7 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.

B. Welded-Construction Automatic Air Vents:

2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install balancing valves in locations where they can easily be adjusted.

C. Install temperature-actuated water mixing valves with strainers, and check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install thermometers and water regulators if specified.
   2. Install cabinet-type units recessed in or surface mounted on wall as specified.

D. Install Y-pattern strainers for water on supply side of each pump.

E. Install water hammer arresters in water piping according to PDI-WH 201.

F. Install air vents at high points of water piping.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 16 Section "Grounding and Bonding."

C. Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Calibrated balancing valves.
2. Primary, thermostatic, water mixing valves.
3. Primary water tempering valves.
4. Outlet boxes.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 15 Section "Mechanical Identification."

3.4 FIELD QUALITY CONTROL
A. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING
A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves as follows:
   1. Set calibrated balancing valves at calculated presettings.
   2. Measure flow at all stations and adjust where necessary.
   3. Record settings and mark balancing devices.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 15145
SANITARY WASTE AND VENT PIPING

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. Related Sections include the following:

1. Division 02 Section “Sanitary Sewage” for piping outside building.
2. Division 15 Section “Mechanical General Requirements”.
3. Division 15 Section “Basic Mechanical Materials and Methods”.
4. Division 15 Section “Drainage Piping Specialties”.
1.2 DEFINITIONS

B. EPDM: Ethylene-propylene-diene terpolymer rubber.
C. LLDPE: Linear, low-density polyethylene plastic.
D. NBR: Acrylonitrile-butadiene rubber.
E. PE: Polyethylene plastic.
F. PVC: Polyvinyl chloride plastic.
G. TPE: Thermoplastic elastomer.

1.3 SYSTEMS DESCRIPTIONS

A. Sanitary waste and vent piping system materials are scheduled on the Drawing.

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.
B. Field quality-control inspection and test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
B. Cast-iron soil pipe shall be marked with the collective trademark of Cast Iron Soil Pipe Institute (CISPI).
C. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and
then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Construction Manager's written permission.

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 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers:
   a. ANACO-Husky; McWane Plumbing Group.
   b. Ferguson Enterprises, Inc.; ProFlo (Private labeled IDEAL-TRIDON).
   c. IDEAL-TRIDON.
   d. Mission Rubber Company; a division of MCP Industries, Inc.
   e. Tyler Pipe; McWane Plumbing Group.

3. Description: NSF certified for compliance with CISPI 310. Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:
Manufacturers:

a. ANACO-Husky; McWane Plumbing Group; SD 4000.
b. Ferguson Enterprises, Inc.; ProFlo (Private labeled IDEAL-TRIDON).
c. IDEAL-TRIDON; Heavy-Duty “HD” No-Hub Couplings.
d. Norma Group; Clamp-All Products; HI-TORQ 125.

2. Standards: ASTM C 1277 and ASTM C 1540, or ASTM C 1277 and FM 1680 Class I.

3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.


B. Hard Copper Tube: ASTM B 88, Types M, water tube, drawn temper.


2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

C. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.


2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
2.4 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: Schedule 40, ASTM D 2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

2.5 SPECIALTY PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:
   b. Fernco, Inc.
   c. Logan Clay Products Company (The).
   d. Mission Rubber Co.
   e. NDS, Inc.
   f. Plastic Oddities, Inc.

2. Sleeve Materials:
   b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:
   b. Mission Rubber Co.
C. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:
   a. ANACO.

D. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:
   a. SIGMA Corp.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Comply with requirements in Division 02 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING SYSTEM INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Sanitary sewer piping outside the building is specified in Division 02 Section "Sanitary Sewerage."

C. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
E. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

F. Install underground, ductile-iron, special pipe fittings according to AWWA C600.

G. Install underground, copper, force-main tubing according to Copper Development Association’s “Copper Tube Handbook.”

H. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

I. 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."

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 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.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
1. Building Sanitary Drain: 1/8-inch per foot downward in direction of flow, unless otherwise noted.
2. Horizontal Sanitary Drainage Piping: 1/8-inch per foot downward in direction of flow, unless otherwise noted.
3. Vent Piping: 1/8-inch per foot down toward vertical fixture vent or toward vent stack.

M. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

N. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

O. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
   1. Install transition couplings at joints of piping with small differences in OD's.
   2. In Drainage Piping: Shielded, nonpressure transition couplings.
   4. In Underground Force Main Piping:
FERNADALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 15, 2018

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 15 Section "Valves."

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 15 Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 15 Section "Hangers and Supports."

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 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 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: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 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.

K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 15 Section "Mechanical Identification."

3.9 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.

3.10 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 15150
SECTION 15155 - DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

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

B. Related Sections include the following:
   1. Division 15 Section “Mechanical General Requirements.”
   2. Division 15 Section “Basic Mechanical Materials and Methods.”
   3. Division 15 Section "Plumbing Fixtures" for hair interceptors.

1.2 DEFINITIONS

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.
D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PUR: Polyurethane plastic.

H. PVC: Polyvinyl chloride plastic.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories.

B. Shop Drawings:
   1. Show fabrication and installation details for frost-resistant vent terminals.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For drainage piping specialties to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.


1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CAST-IRON CLEANOUTS

A. Size: Cleanouts shall be same nominal size as the pipe they serve up to 4 inches. For pipes larger than 4 inches nominal size, minimum size of cleanout shall be 4 inches.

B. Exposed Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
b. MIFAB, Inc.; C1460.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, brass or bronze plug with tapered threads.

C. Cast-Iron Floor Cleanouts (On-Grade Interior Floor Areas):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
b. MIFAB, Inc.; C1220-R.
c. Sioux Chief Manufacturing Company, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products Inc.
g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M.
3. Type: Adjustable housing.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Not required.
7. Closure: Brass, bronze, or plastic plug with tapered threads.
8. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy with scoriated cover in service areas, and recessed cover to accept floor finish material in finished floor areas.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Medium Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

D. Cast-Iron Floor Cleanouts (Not-On-Grade Interior Floor Areas):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.; C-1100-C-R-34.
   c. Sioux Chief Manufacturing Company, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M.
3. Type: Adjustable housing.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Required.
7. Closure: Brass, bronze, or plastic plug with tapered threads.
8. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy with scoriated cover in service areas, and recessed cover to accept floor finish material in finished floor areas.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Medium Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

E. Cast-Iron Wall Cleanouts (Finished Wall Areas):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.; C1460-RD.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Body: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, drilled-and-threaded bronze or brass plug with tapered threads.
5. Wall Access: Round, deep, chrome-plated bronze flat, chrome-plated brass or stainless-steel cover plate with screw.

F. Exterior Surface Area (Outdoor) Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   c. Sioux Chief Manufacturing Company, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products Inc.
g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M.
3. Type: Cast-iron soil pipe with cast-iron ferrule.
4. Body or Ferrule: Cast iron.
5. Outlet Connection: Spigot.
6. Closure: Brass, bronze, or plastic plug with tapered threads.
8. Frame and Cover Shape: Round.
10. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Sink Drains FS-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   b. MIFAB, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.

2. Standard: ASME A112.6.3.
5. Seepage Flange: Required.
7. Outlet: Bottom.
10. Strainer: ABS anti-splash interior bottom dome strainer.
11. Top Shape: Round.
13. Dimensions: 8 inch diameter by 6 inches deep.
14. Outlet Connection: Gray iron, with spigot outlet.

B. Stainless-Steel Floor Sink Drains FS-2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3.
3. Outlet: Bottom unless otherwise noted.
4. Top or Strainer Material: Stainless steel.
5. Top Shape: Square.
6. Dimensions of Top or Strainer: 12 inch by 12 inch, 14 gage, Type 304 stainless steel ribbed, non-tilt loose set no-grate top, and domed bottom strainer.
7. Seepage Flange: Required.
8. Anchor Flange: 10 inch deep body.

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
6. Special Coating: Corrosion resistant on interior of fittings.

2.4 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
   2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Applications: 12 oz./sq. ft.
   2. Vent Pipe Flashing: 8 oz./sq. ft.

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.


E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.
H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 15 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. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. 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.

F. Install through-penetration firestop assemblies in plastic stacks at floor penetrations.

G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

H. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

I. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

J. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints
of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 15155
SECTION 15181 - HYDRONIC PIPING

PART 1 - GENERAL.................................................................1

1.1 RELATED DOCUMENTS..........................................................1
1.2 DEFINITIONS........................................................................2
1.3 SYSTEMS DESCRIPTIONS......................................................3
1.4 SUBMITTALS.................................................................3
1.5 QUALITY ASSURANCE.........................................................3
1.6 EXTRA MATERIALS........................................................4

PART 2 - PRODUCTS..............................................................4

2.1 COPPER TUBE AND FITTINGS..............................................4
2.2 STEEL PIPE AND FITTINGS...............................................5
2.3 JOINING MATERIALS........................................................7
2.4 VALVES........................................................................7
2.5 SPECIALTY VALVES.........................................................7
2.6 CONTROL VALVES........................................................10
2.7 AIR CONTROL DEVICES....................................................11
2.8 HYDRONIC PIPING SPECIALTIES.................................12
2.9 HYDRONIC PIPING STRAINERS..........................................12

PART 3 - EXECUTION..............................................................14

3.1 PIPING SYSTEMS INSTALLATION.....................................14
3.2 HANGERS AND SUPPORTS.............................................16
3.3 PIPE JOINT CONSTRUCTION.............................................18
3.4 HYDRONIC SPECIALTIES INSTALLATION....................18
3.5 TERMINAL EQUIPMENT CONNECTIONS.........................19
3.6 FIELD QUALITY CONTROL.............................................19

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. Related Sections include the following:

1. Division 02 Section “Underground Hydronic Distribution Piping” for preinsulated piping systems.
2. Division 07 Section "Through-Penetration Firestop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.
3. Division 07 Section "Joint Sealants" for materials and methods for sealing pipe penetrations through exterior walls.

4. Division 15 Section “Mechanical General Requirements.”

5. Division 15 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.

6. Division 15 Section "Hangers and Supports" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.

7. Division 15 Section “Pipe Flexible Connectors, Expansion Fittings and Loops.”

8. Division 15 Section "Meters and Gages" for thermometers, flow meters, flow measuring devices, and pressure gages.

9. Division 15 Section "Mechanical Identification" for labeling and identifying hydronic piping.

10. Division 15 Section "General-Duty Valves for HVAC" for general-duty gate, globe, ball, butterfly, and check valves.

11. Division 15 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

12. Division 15 Section "Temperature Controls" for temperature-control valves and sensors.

13. Division 15 Section “Piping Systems Flushing and Chemical Cleaning.”

14. Division 15 Section “HVAC Water Treatment.”

1.2 DEFINITIONS

A. CPVC: Chlorinated polyvinyl chloride.

B. HDPE: High density polyethylene.

C. PP: Polypropylene.

D. PVC: Polyvinyl chloride.

E. PTFE: Polytetrafluoroethylene.

F. RTRF: Reinforced thermosetting resin (fiberglass) fittings.

G. RTRP: Reinforced thermosetting resin (fiberglass) pipe.
1.3 SYSTEMS DESCRIPTIONS

A. Hydronic piping system materials are scheduled on the Drawings.

B. Refer to Application Schedule on the Drawings for valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   2. Drain Duty: Hose-end drain valves.

1.4 SUBMITTALS

A. Product Data: For each type of the following:
   1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
   2. Air control devices.
   4. Hydronic specialties.

B. Shop Drawings: Detail, at minimum 1/4scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Qualification Data: For Installer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in operation and maintenance manuals.

F. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping" for materials, products, and
installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

B. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

C. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be as recommended by the manufacturer of the grooved components.

1.6 EXTRA MATERIALS

A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Socket Fittings: ASME B16.22.

E. Wrought-Copper Unions: ASME B16.22.

F. Grooved Mechanical-Joint Fittings and Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
b. Tyco Fire & Building Products; Grinnell Mechanical Products; Model 672.
c. Victaulic Company; Style 606 and Style 607.

2. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.

3. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.

G. Copper or Bronze Pressure-Seal Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Apollo Valves; by Conbraco Industries; ApolloXpress.
   b. Elkhart Products Corporation; an Aalberts Industries Company; Xpress.
   c. NIBCO Inc.; Press System.
   d. Viega North America; ProPress System.

2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.

H. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube. Mechanically formed tee fittings may be used up to half size of main.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. T-DRILL Industries Inc.

2.2 STEEL PIPE AND FITTINGS

A. Schedule 40 Steel Pipe: ASTM A 53/A 53M or ASTM A 106, Type E or S, Grade A or B. Include ends matching joining method.


7. Flanges: Class 300 forged steel welding neck to match pipe wall thickness and valve flanges, ANSI B16.5. Orifice plate flanges shall be raised face welding neck type with ring joint gaskets and flange taps. Coordinate orifice plate flanges with orifice plate flow elements.

B. Schedule 80 Steel Pipe: ASTM A 53/A 53M or ASTM A 106, Type E or S, Grade A or B. Include ends matching joining method.


2. Screwed Couplings: Extra heavy tapered threaded black carbon steel.

3. Screwed Unions: 300 pound SWP female screwed malleable iron with ground joint and brass to iron seat.


C. Grooved Mechanical-Joint Fittings and Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:


   b. Tyco Fire & Building Products; Grinnell Mechanical Products; Model 772 Rigid Coupling.
c. Victaulic Company; Style 07 Rigid Coupling and 107 QuickVic Rigid Coupling.

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 234, Grade WPB steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

3. Gaskets: Synthetic rubber gasket of central cavity pressure-responsive design suitable for temperatures from minus 30 deg F to 250 deg F.

4. Couplings: Ductile- or malleable-iron housing with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

a. Rigid Type: To provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.

2.3 JOINING MATERIALS

A. Refer to Division 15 Section “Basic Mechanical Materials and Methods.”

2.4 VALVES

A. General Service Valves: Comply with requirements specified in Division 15 Section "General-Duty Valves for HVAC."

2.5 SPECIALTY VALVES

A. Balance Valves:

1. Balance Valves NPS 6 and Larger: Lug type butterfly valves with aluminum bronze disc, AISI 300 Series stainless steel stem, resilient replaceable seat for service at not less than 250 deg F and memory stops. Refer to Division 15 Section “General-Duty Valves for HVAC” for additional requirements.

a. Provide lubricated enclosed screw or worm gear operator with handwheel for sizes 6 inches and larger.
b. Pressure rating shall meet or exceed system minimum pressure rating.


3. Balance Valves for Sizes Less than NPS 6 Combination balance valve and flow measuring device as specified in this Section.

B. Combination, Balancing Valves and Flow Measuring Devices NPS 2 and Smaller:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Flow Design Inc.
   b. Griswold Controls.
   c. Hydronic Components, Inc. (HCi).
   d. Nexus Valve.
   e. PRO Hydronic Specialties, LLC.

2. Manufacturers: Subject to compliance with requirements, use products by one of the following:
   a. Tour & Andersson; TA Hydronics Series available through Victaulic Company of America.
   b. Tyco Fire & Building Products, Grinnell Mechanical Products (formerly marketed by Mepco).

3. Body: Brass or bronze, ball or plug type with calibrated orifice or venturi.
4. Ball: Plated brass, or stainless steel.
5. Plug: Resin.
6. Seat: PTFE.
7. End Connections: Threaded or socket.
9. Handle Style: Lever, with memory stop to retain set position.
10. WOG Rating: Minimum 400 psig.
11. Maximum Operating Temperature: 250 deg F.

C. Combination, Balancing Valves and Flow Measuring Devices NPS 2-1/2 through NSP 4:

HYDRONIC PIPING
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Flow Design Inc.
   b. Griswold Controls.
   c. Hydronic Components, Inc. (Hci).
   d. Nexus Valve.
   e. PRO Hydronic Specialties, LLC.

2. Manufacturers: Subject to compliance with requirements, use products by one of the following:
   a. Tour & Andersson; TA Hydronics Series available through Victaulic Company of America.
   b. Tyco Fire & Building Products, Grinnell Mechanical Products (formerly marketed by Mepco).

3. Body: Cast-iron or steel body, ball, plug, butterfly, or globe pattern with calibrated orifice or venturi.


5. Disc: Glass and carbon-filled PTFE.

6. Seat: PTFE.

7. End Connections: Flanged or grooved.


9. Handle Style: Lever, with memory stop to retain set position.


11. Maximum Operating Temperature: 225 deg F.

D. Combination, Balancing Valves and Flow Measuring Devices NPS 2-1/2 through NSP 4:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Flow Design Inc.
   b. Griswold Controls.
   c. Hydronic Components, Inc. (Hci).
   d. Nexus Valve.
   e. PRO Hydronic Specialties, LLC.

2. Manufacturers: Subject to compliance with requirements, use products by one of the following:
a. Tour & Andersson; TA Hydronics Series available through Victaulic Company of America.
b. Tyco Fire & Building Products, Grinnell Mechanical Products (formerly marketed by Mepco).

3. Body: Cast-iron or steel body, ball, plug, butterfly, or globe pattern with calibrated orifice or venturi.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
9. Handle Style: Lever, with memory stop to retain set position.
11. Maximum Operating Temperature: 225 deg F.

E. Contractor Option for Combination, Balancing Valves and Flow Measuring Devices NPS 2 and Smaller: Preassembled coil hook up kits may be used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Griswold Controls.
   c. Hydronic Components, Inc. (HCi).
   d. Nexus Valve; Coil Pak.
   e. PRO Hydronic Specialties, LLC.

2. Manufacturers: Subject to compliance with requirements, use products by one of the following:
   a. Tour & Andersson; TA Hydronics Series available through Victaulic Company of America.
   b. Tyco Fire & Building Products, Grinnell Mechanical Products (formerly marketed by Mepco).

2.6 CONTROL VALVES

A. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 15 Section "Temperature Controls."
B. Calibrated orifice balancing valves shall not be required on devices where pressure independent characterized control valves (PICCV’s) are installed.

2.7 AIR CONTROL DEVICES

A. Manual Air Vents: Use ball-valve-type hose-end drain valves, refer to Division 15 Section "Valves."

B. Automatic Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett; Xylem Inc.
   d. Spirotherm, Inc.
   e. Taco, Inc.

2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
5. Inlet Connection: NPS 1/2.
8. Maximum Operating Temperature: 240 deg F.

C. Bladder-Type Expansion Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett; Xylem Inc.
   d. Taco, Inc.

2. Tank: Welded steel, rated for 125-psig working pressure and 240 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.


D. Combination Air and Dirt Separators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Spirotherm, Inc.; VDN Series.

2. Body: Fabricated steel; constructed for 150-psig maximum working pressure and 250 deg F maximum operating temperature. Separator shall have body extended below pipe connections for dirt separation and include removable lower head.

3. Air and Dirt Separation Mechanism: Internal copper core tube with continuous wound copper medium permanently attached followed by continuous wound copper wire permanently affixed.

4. Venting Chamber: With integral full port, float actuated brass venting mechanism. Include valved side tap to flush floating dirt or liquids and for quick bleeding of air during system fill.

5. Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.


7. Size: Match system flow capacity.

2.8 HYDRONIC PIPING SPECIALTIES

A. Diverting Fittings: 125-psig working pressure; 250 deg F maximum operating temperature; cast-iron body with threaded ends, or wrought copper with soldered ends. Indicate flow direction on fitting.

B. Flexible connectors and expansion fittings are specified in Division 15 Section "Pipe Flexible Connectors, Expansion Fittings and Loops."

2.9 HYDRONIC PIPING STRAINERS

A. Manufacturers:
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 15, 2018

1. Keckley.
2. Metraflex.
4. Nibco, Inc.
5. Spence.
6. Sure Flow Equipment Inc.
7. Watts Water Technologies, Inc.
8. Yarway.
10. Tyco Fire & Building Products, Grinnell Mechanical Products (for grooved piping)
11. Victaulic Company; (for grooved piping).

B. Y-Pattern Strainers, Bronze:

1. CWP: 200 psig minimum, unless otherwise indicated.
2. SWP: 125 psig minimum, unless otherwise indicated.
4. End Connections: Threaded or soldered.
5. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
6. Drain:
   a. Pipe plug for sizes NPS 2 and smaller.
   b. Factory-installed, hose-end drain valve for sizes NPS 2-1/2 and larger.

C. Y-Pattern Strainers, Cast and Ductile Iron:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection; or ASTM A 536, Grade 65-45-12, ductile-iron with coupled cover and drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger; grooved ends may be used on grooved piping.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP: 200 psig minimum, unless otherwise indicated.
5. SWP: 125 psig minimum, unless otherwise indicated.
6. Drain:
   a. Pipe plug for sizes NPS 2 and smaller.
b. Factory-installed, hose-end drain valve for sizes NPS 2-1/2 and larger.

D. Basket Strainers, Cast Iron:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP: 200 psig minimum, unless otherwise indicated.
5. SWP: 125 psig minimum, unless otherwise indicated.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.
H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping, other than drain piping, at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Division 15 Section "General-Duty Valves for HVAC."

Q. 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.

R. Install calibrated balancing valves in the return water line of each heating or cooling element and elsewhere as required to facilitate system balancing.

S. Install check valves at each pump discharge and elsewhere as required to control flow direction.

T. 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.

U. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

V. Install flanges or grooved mechanical couplings in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

W. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and where 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.

X. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 15 Section "Pipe Flexible Connectors, Expansion Fittings and Loops."

Y. Identify piping as specified in Division 15 Section "Mechanical Identification."

3.2 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 15 Section "Hangers and Supports." Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
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.
9. NPS 8: Maximum span, 19 feet; minimum rod size, 5/8 inch.
10. NPS 10: Maximum span, 20 feet; minimum rod size, 3/4 inch.
11. NPS 12: Maximum span, 23 feet; minimum rod size, 7/8 inch.
12. NPS 14: Maximum span, 25 feet; minimum rod size, 1 inch.
13. NPS 16: Maximum span, 27 feet; minimum rod size, 1 inch.
14. NPS 18: Maximum span, 28 feet; minimum rod size, 1-1/4 inches.
15. NPS 20: Maximum span, 30 feet; minimum rod size, 1-1/4 inches.

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.
7. NPS 4 to NPS 5: Maximum span, 10 feet minimum rod size, 1/2-inch.
8. NPS 6: Maximum span, 10 feet minimum rod size, 5/8-inch.
9. NPS 8: Maximum span, 10 feet minimum rod size, 3/4-inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.3 PIPE JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.4 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Glycol Systems:

1. Install automatic air vents on expansion tanks and install high capacity automatic air vents on air separators. Route vent piping to spill over glycol fill station.
2. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

D. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.
E. Install combination air/dirt separator in pump suction. Install blowdown piping with ball valve; extend full size to nearest floor drain.

F. Install expansion tanks as indicated in piping diagrams. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.
3. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

3.5 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 15 Section "Meters and Gages."

3.6 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of
sealing against test pressure without damage to valve.
Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than
one-third higher than test pressure, to protect
against damage by expanding liquid or other source of
overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium
unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible
with piping may be used.
2. While filling system, use vents installed at high
points of system to release air. Use drains installed
at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic
system is full of water.
4. Subject piping system to hydrostatic test pressure
that is not less than 1.5 times the system's working
pressure. Test pressure shall not exceed maximum
pressure for any vessel, pump, valve, or other
component in system under test. Verify that stress due
to pressure at bottom of vertical runs does not exceed
90 percent of specified minimum yield strength or 1.7
times "SE" value in Appendix A in ASME B31.9,
"Building Services Piping."
5. After hydrostatic test pressure has been applied for
at least 2 hours, examine piping, joints, and
connections for leakage. Eliminate leaks by
tightening, repairing, or replacing components, and
repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Remove disposal fine-mesh strainers in pump suction
diffusers.
4. Set makeup pressure-reducing valves for required
system pressure.
5. Inspect air vents at high points of system and
determine if all are installed and operating freely
(automatic type), or bleed air completely (manual type).

6. Set temperature controls so all coils are calling for full flow.

7. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.

8. Verify lubrication of motors and bearings.

END OF SECTION 15181
SECTION 15188 - PIPING SYSTEMS FLUSHING AND CHEMICAL CLEANING

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. Related Sections include the following:

1. Division 15 Section “Mechanical General Requirements.”
2. Division 15 Section “Basic Mechanical Materials and Methods.”

1.2 SUMMARY

A. This Section includes chemical cleaning for the following piping systems:

1. Existing heating hot water, at Ferndale High School.
1.3 DEFINITIONS

A. Cleaning: Recirculating water containing chemical cleaning and passivation compounds.

B. Flushing: Using approved water on a once through basis.

1.4 PERFORMANCE REQUIREMENTS

A. Furnish the services of a firm specializing in piping system chemical cleaning and water treatment work.

1. For chemical cleaning: This firm shall select the required type and quantity, based on system volume, of cleaning compound, and method of application.

B. Passivation for Galvanized Steel: Open loop only, for the first two weeks of operation.

1.5 SUBMITTALS

A. Product Data:

1. Proposed cleaning chemicals and quantities.
2. Proposed passivation chemicals and quantities.
3. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

B. Shop Drawings: Reduced scale plans indicating locations of velocity measurements.

C. Field quality-control test reports.

D. Other Informational Submittals:

2. Circulation pump suction and discharge pressure at start and completion of chemical cleaning operations.

1.6 QUALITY ASSURANCE

A. Service Provider Qualifications: An experienced piping systems cleaning service provider capable of applying cleaning compounds as specified in this Section.
B. Conduct safety meetings with Owner’s Representative and personnel involved in the cleaning process.

C. Assume responsibility for damage, necessary subsequent cleaning, flushing, and inspection of Work under the Contract which results from improper flushing and cleaning operations including failure to flush all dead-ends.

1.7 COORDINATION

A. Schedule flushing and chemical cleaning activities immediately after piping system pressure testing and immediately prior to piping system chemical treatment work to minimize internal oxidization or flash corrosion of piping systems.

B. Coordinate chemical cleaning work with other work to avoid accidental chemical discharge, spillage, or spray out, and electrolytically originated system damage resulting from concurrent chemical cleaning and arc welding.

C. Coordinate with work performed under other Sections to provide in-place temporary strainers, spool pieces, flushing hose connections, cross-over piping, and isolation and drain valves.

D. Boilers shall be flushed and cleaned to remove rust and oil deposits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. System Cleaning Chemicals: Subject to compliance with requirements, provide products by:

1. Acceptable Manufacturers:
   a. PVS-Nolwood Chemicals, Inc.; PVS CHILL CLP Cleaner.
   b. Nalco, an Ecolab Company.
   c. Mitco Custom Water Treatment.
   d. H-O-H Chemicals, Inc.
   e. GE Power & Water; Water & Process Technologies.
   f. Enerco Corporation.
2.2 MATERIALS

A. Cleaning chemicals shall be as recommended by manufacturer and compatible with piping system components and connected equipment.

B. Cleaning and passivation chemical shall consist of an inorganic phosphate, yellow metal corrosion inhibitor (Tolytriazole), dispersant, and oil emulsifier.

C. Provide additional temporary and permanent piping, equipment, and materials required for chemical cleaning work.

D. Use potable water for flushing and cleaning operations, unless directed otherwise by the Architect.

PART 3 - EXECUTION

3.1 ACCEPTABLE SERVICE PROVIDER

A. Subject to compliance with requirements, provide chemical cleaning service by:

1. Acceptable Providers:
   a. Eldon Water (Patrick Racine, Christa Blades, or Pierre Beausoleil, 888-712-4000).
   b. Enerco Corporation (Doug White 517-627-8444 or 800-292-5908).
   c. GE Power & Water; Water & Process Technologies.
   d. Mitco Custom Water Treatment (Gordon Chapin, 800-516-2175).
   e. Nalco, an Ecolab Company (Brian Irwin or Tony Mackovski, 248-344-7564).

3.2 PREPARATION

A. Prior to flushing and cleaning activities, drain the system of all water used for hydrostatic testing.

B. Temporarily connect dead-end supply and return piping as necessary to result in recirculating system in which no lines are left static for purposes of flushing and cleaning. Refer to System Piping Diagrams on the Drawings
for suggested locations of temporary connections for flushing and cleaning purposes.

C. Select three locations for monitoring flow rates.

3.3 INITIAL FLUSHING

A. Remove loose dirt, mill scale, metal chips, weld beads, rust and other deleterious substances without damage to system components.

B. Bypass factory cleaned equipment, unless acceptable means of protection are provided and subsequent inspection of water boxes and other "hide-out" areas takes place.

C. Isolate or protect clean system components including pumps and pressure vessels and remove components which may be damaged.

D. Open valves, drains, vents and strainers at all system levels.

E. Remove plugs, caps, spool pieces and components to facilitate early discharge from system.

F. Sectionalize system if possible to obtain debris carrying velocity of 6 FPS.

G. Connect dead-end supply and return headers as necessary or provide terminal drains in end caps.

H. Install temporary strainers where necessary to protect down-stream equipment.

I. Supply and remove flushing water and drainage by fire hoses, garden hoses, temporary and permanent piping and Contractor's booster pumps.

J. Flush for not less than one hour.

K. Inspect system including basins to determine if debris accumulation requires dewatering and cleaning prior to next phase work.
3.4 FLUSHING AND CHEMICAL CLEANING PROCEDURES

A. Remove without chemical or mechanical damage to system components adherent dirt (organic soil), oil and grease (hydrocarbons), welding and soldering flux, mill varnish, pipe compounds, rust (iron oxide), and other deleterious substances not removed by initial flushing. Removal of tightly adherent mill scale is not required.

B. Fill system with fresh water and add manufacturer’s recommended volume of system cleaner to remove grease and petroleum products from piping. Circulate solution for 48 hours at a minimum velocity of 6 fps.

1. Utilize defoamers to preclude damage to existing work and adjacent electrical equipment.
2. Utilize heat to maximize effectiveness of compounds or use live steam injection where practical and safe. Do not raise cleaning water temperature in excess of controlled limits.

C. Monitor flow rates and clean strainers as required to maintain minimum specified velocity during the entire circulation and chemical cleaning period.

D. Cleaning of new piping systems shall be completed prior to connection of systems to existing services.

E. Install temporary strainer screens between pipe flange faces where necessary to protect primary system from branch connections during chemical cleaning procedures.

F. Following chemical cleaning:

1. Remove, clean, and reinstall strainer baskets.
2. Blow down and clean low points, dirt legs, and traps.

G. Drain systems:

1. Check with local authorities concerning discharge requirements and submit copies of letters or reports.
2. If acceptable, drain system to sanitary drainage system.
3. Do not under any circumstances drain to storm drainage system or open drainage ditch.
4. If discharge requirements do not allow discharge to sanitary sewer, secure the services of a licensed disposal Contractor.

5. Disposal Contractors:
   a. Dynecol.
   b. SQS Environmental.

H. Perform final flush to remove any remaining debris and chemical from the system:
   1. Flush dead ends and isolated pre-cleaned equipment.
   2. Operate valves to dislodge debris in valve body.
   3. Flush for not less than 1 hour.

3.5 PLACING INTO OPERATION

A. Clean strainers.

B. Dewater and clean new sumps, basins, storage vessels and pressure vessels.

C. Disassemble, inspect, clean, repair, replace and reassemble any critical component or questionable item. Bellows style, and hose and braid flexible connectors left in place shall be removed and cleaned.

D. Preliminarily adjust control valves.

E. Install clean primary filter elements, if necessary, as determined by both pressure differential across filter and visual inspection of filter elements.

F. Close-up and fill system as soon as possible to minimize corrosion of untreated surfaces.

G. Vent air from system and adjust fill valve.

H. Immediately after completion of flushing and chemical cleaning, fill systems with potable water and make ready for chemical treatment as specified in Division 15 Section "HVAC Water Treatment."

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Withdraw, inspect, and test samples of water from each system after flushing and chemical cleaning is completed, to ensure system is free of contaminants.

2. If loose debris or contaminants are still present, repeat final flushing procedures until test samples and strainers remain free of debris and contaminants.

END OF SECTION 15188
SECTION 15189 - HVAC WATER TREATMENT

PART 1 - GENERAL
1.1 RELATED DOCUMENTS
1.2 DEFINITIONS
1.3 PERFORMANCE REQUIREMENTS
1.4 SUBMITTALS
1.5 QUALITY ASSURANCE
1.6 OWNER’S INSTRUCTIONS
1.7 MAINTENANCE SERVICE

PART 2 - PRODUCTS
2.1 MANUFACTURERS
2.2 MANUAL CHEMICAL-FEED EQUIPMENT
2.3 CHEMICAL FEED PIPE AND FITTINGS
2.4 CHEMICAL TREATMENT TEST EQUIPMENT
2.5 CHEMICALS

PART 3 - EXECUTION
3.1 WATER ANALYSIS
3.2 FIELD QUALITY CONTROL
3.3 DEMONSTRATION

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. Related Sections include the following:

1. Division 15 Section “Mechanical General Requirements.”
2. Division 15 Section “Basic Mechanical Materials and Methods.”
3. Division 15 Section “Piping Systems Flushing and Chemical Cleaning.”

1.2 DEFINITIONS

A. CPVC: Chlorinated Polyvinyl Chloride.

B. EEPROM: Electrically erasable, programmable read-only memory.
C. EPDM: Ethylene-propylene-diene monomer.

D. FMP: Fluoroelastomer.

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

F. MDA: Michigan Department of Agriculture.

G. RO: Reverse osmosis.

H. TDS: Total dissolved solids.

I. PTFE: Polytetrafluoroethylene.

J. UV: Ultraviolet.

1.3 PERFORMANCE REQUIREMENTS

A. Furnish the services of a firm specializing in hydronic piping system water treatment work, for Fraser High School.

1. This firm shall furnish and administer glycol for systems using glycol/water mix.

B. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

C. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

D. Closed hydronic systems, including hot-water heating with non-aluminum boilers and chilled water, shall have the following water qualities:

1. pH: Maintain a value within 9.0 to 10.5.
2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
3. Boron: Maintain a value within 100 to 200 ppm.
4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
6. TDS: Maintain a maximum value of 5000 mmhos.
7. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
8. Microbiological Limits:
   a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
   b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
   c. Ammonia: Maintain a maximum value of 20 ppm.
   d. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
   e. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
   f. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for the following products:

1. Bypass feeders.
2. Water meters.
3. Inhibitor injection timers.
4. pH controllers.
5. TDS controllers.
7. Chemical solution tanks.
8. Injection pumps.
9. Ozone generators.
10. UV-irradiation units.
11. Chemical test equipment.
12. Chemical material safety data sheets.
14. RO units.

B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans,
elevations, sections, details, and attachments to other work.


C. Field quality-control test reports.

D. Operation and Maintenance Data: For sensors, injection pumps, and controllers to include in operation and maintenance manuals.

1. Submit under provisions of Division 15 Section “Mechanical General Requirements” and as supplemented in this Section.

2. Submit following operation and maintenance data as minimum for purified water system.

   a. Furnish complete instruction manuals for installation, operation, maintenance, and lubrication requirements for each component of mechanical and electrical equipment or system.

   b. Each instruction manual shall include, but not be limited to, the following:

      1) Diagrams and illustrations.
      2) Detailed description of the function of each principal component of the system.
      3) Performance and nameplate data.
      4) Installation instructions.
      5) Procedures for starting.
      6) Proper adjustment.
      7) Test procedures and recording of operation data.
      8) Procedures for operating.
      9) Shutdown and restart instructions.
     10) Emergency operating instructions and troubleshooting guide.
     11) Safety precautions.
     12) Maintenance and overhaul instructions which shall include detailed assembly drawings with part numbers, recommended spare parts list, instructions for ordering spare parts (including suppliers names), and complete preventive maintenance instructions required to ensure satisfactory performance and longevity of the equipment.
13) Lubrication instructions, which shall list points to be greased or oiled, shall recommend type, grade, and temperature range of lubricants, and shall recommend frequency of lubrication.

14) List of electrical relay settings and control and alarm contact settings.

15) Electrical interconnection wiring diagram for equipment furnished, including all control.

c. Manual shall be complete in all respects for all equipment, controls, accessories, and associated appurtenances.

d. Each O&M Manual shall be transmitted to the Owner's representative and Architect prior to installation of the equipment and all equipment shall be serviced by the manufacturer in accordance with the manufacturer's recommendations prior to operation. A service record shall be maintained on each item of equipment and shall be delivered to the Owner's representative and Architect prior to final acceptance of the project.

E. Other Informational Submittals:

1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.

2. An analytical review of make-up water characteristics for each treated system operating conditions, including such items as Langlier/Ryzner Indexes. Based on this review, provide a definitive description of treatment system developed to achieve specified objectives and include generic terms to describe product formulation content and function. Detailed proprietary formulation data is not required. However, manufacturer's standard published literature is not usually acceptable.

3. A step-by-step procedure to be followed by the Contractor during flushing, purging, disinfecting, draining, disposal, pretreatment and treatment operations. The intent of the step-by-step procedure is two-fold.
a. To assure that all essential permanent provisions to accomplish the above work are included during the course of construction.

b. To allow the Owner to accomplish the source procedures as subsequent maintenance operations.

F. Provide OSHA equivalent materials form for hazardous substances.

1.5 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Conform to applicable codes for addition of non-potable chemicals to building mechanical systems, and for delivery to public sewage systems.

1.6 OWNER’S INSTRUCTIONS

A. Provide a coordinated water treatment training program oriented to the needs common to operating personnel and maintenance personnel and to the needs of maintenance personnel only, sufficiently prior to acceptance of the work, upon mutually satisfactory arrangement with the Architect.

B. Provide a total of not less than eight "field" hours encompassing mechanical, electrical, chemical, pollution and safety aspects, sufficient for personnel to operate and maintain systems and consistently achieve specified objectives, with subsequently scheduled guidance by the water treatment laboratory.

C. Water treatment laboratory chemical engineer, complemented by instrument engineer, supplemented by Contractor's staff, shall comprise the training staff.
D. Training materials shall include "survey," limits control program, shop drawings, operating and maintenance manuals, safe handling of chemicals, chemical testing, use of log sheets and demonstrations of installed and functioning systems.

E. On completion of the installation of the entire purified water system, conduct a thorough check and test of all components in the system. During this period, instruct the Owner's personnel in the theory, operation, and maintenance of the system. When this work is finished, start up the system and operate it for as long as necessary to complete two consecutive days of operation at the specified performance levels. During this period, continue to instruct the Owner's personnel.

1.7 MAINTENANCE SERVICE

A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for cooling, chilled-water piping heating, hot-water piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:

1. Provide piping/plumbing recommendation to optimize chemical program results.
2. Initial water analysis and HVAC water-treatment recommendations.
3. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
4. Quarterly field service and consultation.
5. Customer report charts and log sheets.
6. Laboratory technical analysis.
7. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

B. Glycol manufacturer shall provide testing services every six months of samples submitted by the Owner. Fluid shall be tested at no charge for: glycol percent, pH, reserve alkalinity, dissolved metals, magnesium, calcium,
chlorides, acidity, and inhibitor components. Testing service shall be for the life of the fluid.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers/Supplier: Unless otherwise specified, and subject to compliance with requirements, utilize the District’s current HVAC Water Treatment Contractor below:

1. Chemsearch; Contact Bob Sevy at (248)342-2585.

2.2 MANUAL CHEMICAL-FEED EQUIPMENT

A. Utilize existing shot feeder.

2.3 CHEMICAL FEED PIPE AND FITTINGS

A. Utilize existing piping:

2.4 CHEMICAL TREATMENT TEST EQUIPMENT

A. Test Kit: Utilize existing equipment.

2.5 CHEMICALS

A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1 "Performance Requirements" Article.

B. Water Softener Chemicals:

1. Mineral: High-capacity, sulfonated-polystyrene ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock. Resin exchange capacity minimum 30,000 grains/cu. ft. of calcium carbonate of resin when regenerated with 15 lb of salt.

2. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are not acceptable.

C. For Aluminum Boilers: Use one of the following:
1. **Multi-Metal Corrosion Inhibitor and Dispersant:** Neutral pH formulation designed to provide corrosion inhibition of ferrous, stainless, copper, and aluminum alloys in closed recirculating water systems, and also containing polymeric dispersants and sequestrants to aid in maintaining clean internal surfaces.

   a. **Dispersant Package:** Quadpolymer/phosphonate blend.
   b. **Molybdenum Tracer:** For ease of testing and control.
   c. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
      
      1) Fernox USA.
      2) H-O-H Water Technology, Inc.
      3) Rhomar Water Management, Inc.; Pro-Tek AL.
      4) Sentinel Performance Solutions Ltd.

2. **Multi-Metal Corrosion Inhibitor and Dispersant:** Neutral pH formulation designed to provide corrosion inhibition of ferrous, stainless, copper, and aluminum alloys in closed recirculating water systems, and also containing polymeric dispersants and sequestrants to aid in maintaining clean internal surfaces.

   a. **Dispersant Package:** Quadpolymer/phosphonate blend.
   b. **Molybdenum Tracer:** For ease of testing and control.
   c. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
      
      1) Fernox USA.
      2) H-O-H Water Technology, Inc.
      3) Rhomar Water Management, Inc.; Pro-Tek AL.
      4) Sentinel Performance Solutions Ltd.

**PART 3 - EXECUTION**

3.1 **WATER ANALYSIS**

   A. Perform an analysis of supply water to determine quality of water available at Project site.
3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust existing components, existing assemblies, and existing equipment installations, including connections. Report results in writing.

B. Tests and Inspections:

1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
7. 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 test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
8. Repair leaks and defects with new materials and retest piping until no leaks exist.

C. Remove and replace malfunctioning units and retest as specified above.

D. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare test report advising Owner of changes necessary to adhere to
Part 1 "Performance Requirements" Article for each required characteristic. Sample boiler water at four -week intervals following the testing noted above to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section.

E. At four -week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article.

F. Comply with ASTM D 3370 and with the following standards:


3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment. Refer to Division 15 Section "Mechanical General Requirements."

END OF SECTION 15189
SECTION 15194 - FUEL GAS 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.

B. Related Sections include the following:

1. Division 15 Section “Mechanical General Requirements.”
2. Division 15 Section “Basic Mechanical Materials and Methods.”

1.2 SUMMARY

A. This Section includes facility fuel gas piping.

1.3 DEFINITIONS

A. Gas Main: Utility's natural gas piping.

B. Gas Distribution: Piping from gas main to individual service-meter assemblies.

C. Fuel Gas Piping: Piping that conveys fuel gas from point of delivery to fuel gas utilization devices inside the building.

D. PE: Polyethylene.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: Performance requirements are scheduled on the Drawings.

2. Exception: Fuel Gas Piping Installed within Ceilings Used as Plenums: 150 psig.

1.5 SYSTEMS DESCRIPTIONS

A. Fuel gas piping system materials are scheduled on the Drawing.

1.6 SUBMITTALS

A. Product Data: For the following:

1. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

2. Pressure regulators. Include pressure rating, capacity, and settings of selected models.

B. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with
other installations, using input from installers of the items involved.

C. Welding certificates.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For natural gas specialties and accessories to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, “Welding and Brazing Qualifications.”

B. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.


1.8 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition.Notify fuel gas supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.
1.9 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Gas System Pressure: Not more than 5.0 psig.

C. Design values of fuel gas supplied for these systems are as follows:
   1. Nominal Heating Value: 1000 Btu/cu. ft.
   2. Nominal Specific Gravity: 0.6.

1.10 COORDINATION

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

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 BLACK STEEL PIPE AND FITTINGS

A. Black Steel Pipe: ASTM A 53/A 53M; Type E or S; Grade B; Schedule 40. Wall thickness of wrought-steel pipe shall comply with ASME B36.10M.

2. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
7. Steel Flanges and Flanged Fittings: ASME B16.5.
8. Gasket Material: Thickness, material, and type suitable for natural gas.

2.3 PIPING SPECIALTIES


C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.
2.4 JOINING MATERIALS

A. Refer to Division 15 Section “Basic Mechanical Materials and Methods.”

2.5 SPECIALTY VALVES

A. Valves, NPS 3 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, NPS 4 and Larger: Flanged ends according to ASME B16.5 for steel flanges.

C. Gas Valves, NPS 3 and Smaller: Bronze or brass body with AGA or CSA stamp, UL listed or FM approved for service, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 125-psig minimum pressure rating.

1. Manufacturers:
   a. Conbraco Industries, Inc.
   b. Crane Valves.
   c. Jomar International Ltd.
   d. Legend Valve and Fitting, Inc.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Watts Water Technologies, Inc.; Watts Regulator Co.

2. Tamperproof Feature: Include design for locking.

D. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers:
   b. Homestead Valve; a division of Olson Technologies, Inc.
   c. Milliken Valve Company.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.
8. Pressure Class: 125 psig.

2.6 PRESSURE REGULATORS

A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.

1. Manufacturers:
   a. Service Pressure Regulators:
      1) Elster Gas North America; Elster American Meter.
      3) Itron Gas.
   b. Line Pressure Regulators:
      1) American Meter Company.
      2) Fisher Controls International, Inc.; Division of Emerson.
      3) Itron Gas.

2. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
3. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges.

   B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.
PART 3 - EXECUTION

3.1 EXCAVATION
A. Refer to Division 02 Section “Earthwork” for excavating, trenching, and backfilling.

3.2 EXAMINATION
A. Examine roughing-in for fuel gas piping system to verify actual locations of piping connections before equipment installation.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION
A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.4 PIPING SYSTEM INSTALLATION
B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
C. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
D. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels, unless indicated to be exposed to view.

E. Concealed Locations:

1. Above Inaccessible Ceiling Locations: Gas piping with welded joints may be installed in inaccessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves or unions above inaccessible ceilings.

2. Above Accessible Ceiling Locations: Gas piping with welded joints may be installed in accessible ceiling spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves or unions above ceilings used as plenums.

3. In Floor Channels: Gas piping may be installed in floor channels, subject to approval of authorities having jurisdiction. Channels must have cover and be open to space above cover for ventilation.

4. Underground Beneath Building: Gas piping may be installed in protective conduit in accordance with Chapter "Gas Piping Installations" in the International Fuel Gas Code.

5. In Partitions: Do not install concealed piping in solid partitions, unless installed in a chase or casing.
   a. Exception: Piping passing through partitions or walls.

6. In Walls: Gas piping with welded joints and protective wrapping specified in Part 2 "Protective Coating" Article may be installed in masonry walls, subject to approval of authorities having jurisdiction.

7. Prohibited Locations: Do not install gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.

F. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.
1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

G. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.

H. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

I. Connect branch piping from top or side of horizontal piping.

J. Install strainer on inlet of each automatic and electrically operated valve.

K. Install pressure gage upstream and downstream from each line pressure regulator. Pressure gages are specified in Division 15 Section "Meters and Gages."

L. Locate valves for easy access.

M. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

N. Install flanges when connecting to valves, specialties, and equipment having NPS 2-1/2 and larger connections.

O. Install gas valve or plug valve and strainer upstream from each line pressure regulator or appliance pressure regulator.

P. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

Q. Install containment conduits for gas piping below slabs, within building, in gastight conduits extending minimum of 4 inches outside building, and vented to atmosphere. Terminate vents with turned-down, reducing-elbow fittings.
with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal-tar, epoxy-polyamide paint according to SSPC-Paint 16.

3.5 JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Use materials suitable for fuel gas.

C. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support and equipment support materials and installation requirements are specified in Division 15 Section "Hangers and Supports."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

C. Support vertical steel pipe at each floor and at spacing not greater than 15 feet.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.

B. Install piping adjacent to appliances to allow service and maintenance.
C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

3.8 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator, and specialty valve.

1. Text: In addition to name of identified unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

2. Nameplates, pipe identification, and signs are specified in Division 15 Section "Mechanical Identification."

3. Trace Wire: Yellow insulated, minimum 18 AWG wire, having copper or other approved conductor, with insulation suitable for direct burial, installed adjacent to underground nonmetallic piping, with aboveground access to tracer wire at each end of pipe.

3.9 PAINTING

A. Use materials and procedures in Division 09 painting Sections.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

   c. Topcoat: Exterior alkyd enamel (flat).
   d. Color: Gray.
C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.

C. Additional Testing: Subject welded fuel gas piping installed within ceiling spaces used as plenums to test pressure of 150 psig for a minimum of 2 hours.

D. Natural-gas piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 15194
SECTION 15441 - DOMESTIC WATER CIRCULATION PUMPS

PART 1 - GENERAL..........................................................1
  1.1 RELATED DOCUMENTS..................................................1
  1.2 SUBMITTALS............................................................1
  1.3 QUALITY ASSURANCE..................................................2
  1.4 DELIVERY, STORAGE, AND HANDLING...............................2

PART 2 - PRODUCTS...........................................................2
  2.1 MANUFACTURERS......................................................2
  2.2 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS (SMALL)...........3
  2.3 CONTROLS.............................................................3

PART 3 - EXECUTION..........................................................4
  3.1 EXAMINATION..........................................................4
  3.2 PUMP INSTALLATION..................................................4
  3.3 CONTROL INSTALLATION.............................................4
  3.4 CONNECTIONS........................................................5
  3.5 STARTUP SERVICE....................................................5
  3.6 DEMONSTRATION.....................................................6

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. Related Sections include the following:
   1. Division 15 Section “Mechanical General Requirements.”
   2. Division 15 Section “Basic Mechanical Materials and Methods.”

1.2 SUBMITTALS

A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.
C. Operation and Maintenance Data: For domestic water pumps to include in emergency, operation, and maintenance manuals.

1.3 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.

D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components - Lead Content for potable domestic water piping and components.

E. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

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 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS (SMALL)

A. Manufacturers:

1. Armstrong Pumps Inc.
2. Bell & Gossett; Xylem Inc.; Series PL.
3. Grundfos Pumps Corp.
4. Taco, Inc.; Series 1400.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; and designed for installation with pump and motor shafts mounted horizontally.

1. Pump Construction: All bronze.
   a. Casing: Radially split, bronze, with threaded companion-flange connections.
   b. Impeller: Glass-reinforced corrosion-resistant material; keyed to shaft.
   c. Shaft: High-strength alloy steel.
   d. Seal: Mechanical, carbon/silicon carbide seal.
   e. Bearings: Permanently oil-lubricated type.

2. Motor—Single speed, with oil-lubricated bearings, unless otherwise indicated; and directly mounted to pump casing. Comply with requirements in Division 15 Section “Motors.”

C. Capacities and Characteristics: Refer to Schedule on Drawings.

2.3 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Manufacturers:
   a. Honeywell International, Inc.
   b. Square D.
2. Type: Water-immersion sensor, for installation in hot-water circulation piping.
3. Range: 65 to 200 deg F (18 to 93 deg C].
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
7. Settings: Start pump at 125 deg F (52 deg C).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping. Do not use pump motors as a support point.

D. Install centrifugal pumps with motor and pump shafts horizontal.

E. Install continuous-thread hanger rods and spring hangers of sufficient size to support pump weight. Vibration isolation devices are specified in Division 15 Section "Mechanical Vibration Controls." Fabricate brackets or supports as required. Hanger and support materials are specified in Division 15 Section "Hangers and Supports."

3.3 CONTROL INSTALLATION

A. Install strap on thermometer (aquastat) on hot-water return piping.
3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 15 Section "Domestic Water Piping."

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
   b. Close-coupled, vertically mounted, in-line centrifugal pumps.

2. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 15 Section "Valves" for general-duty valves for domestic water piping and Division 15 Section "Domestic Water Piping Specialties" for strainers.

D. Ground equipment according to Division 16 Section "Grounding and Bonding."

E. Connect wiring according to Division 16 Section "Conductors and Cables."

F. Connect thermostats to pumps that they control.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set thermostats for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:
   a. Verify bearing lubrication.
   b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
   c. Verify that pump is rotating in the correct direction.
6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION
SECTION 15485 - ELECTRIC DOMESTIC WATER HEATERS

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. Related Sections include the following:

1. Division 15 Section “Mechanical General Requirements.”
2. Division 15 Section “Basic Mechanical Materials and Methods.”

1.2 SUBMITTALS

A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail water heater assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Product Certificates: For each type of electric water heater, signed by product manufacturer.

D. Source quality-control test reports.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For electric water heaters to include in operation and maintenance manuals.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of electric water heaters and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. ASHRAE Standards: Comply with performance efficiencies prescribed for the following:


F. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.
1.4 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

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 LIGHT-COMMERCIAL ELECTRIC WATER HEATERS

A. Description: Comply with UL 174 for household, storage electric water heaters.

1. Manufacturers:
   b. Lochinvar Corporation.
   c. PVI Industries, LLC; Durawatt CL Series.
   d. Smith, A. O. Water Products Company; Gold Series and Dura-Power DEN and DEL Models.

2. Storage-Tank Construction: Steel, vertical arrangement.

   b. Pressure Rating: 150 psig (1035 kPa).
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

3. Factory-Installed Storage-Tank Appurtenances:

   a. Anode Rod: Replaceable magnesium required for glass lined tanks.
   b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
   c. Drain Valve: ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1.

e. Jacket: Steel with enameled finish.

f. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.

g. Heating Elements: One; electric, screw-in immersion type; wired for simultaneous operation, unless otherwise indicated.

h. Temperature Control: Adjustable thermostat for each element.

i. Safety Control: High-temperature-limit cutoff device or system.

j. Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

k. Fabricated steel stand.

4. Capacity and Characteristics: Refer to Schedule on Drawings.

2.3 EXPANSION TANKS

A. Description: Steel, pressure-rated tank, ASME-code constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

1. Manufacturers:

   a. AMTROL Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett; Xylem Inc.
   d. Taco, Inc.
   e. Wessels Co.

2. Construction:

   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.

   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings,
including extending finish into and through tank fittings and outlets.

c. Air-Charging Valve: Factory installed.

3. Capacity and Characteristics: Refer to Schedule on Drawings.

2.4 WATER HEATER ACCESSORIES

A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

B. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches (457 mm) above the floor.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

D. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test water heater storage tanks before shipment to minimum of one and one-half times pressure rating.

C. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards.
Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

B. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

C. Install combination temperature and pressure relief valves in water piping for water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 15 Section "Valves" for hose-end drain valves.

E. Install thermometer on outlet piping of water heaters. Refer to Division 15 Section "Meters and Gages" for thermometers.

F. Install pressure gage(s) on outlet of commercial electric water-heater piping. Refer to Division 15 Section "Meters and Gages" for pressure gages.

G. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

H. Fill water heaters with water.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

C. Ground equipment according to Division 16 Section "Grounding and Bonding."

D. Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove water heaters that do not pass tests and inspections. Replace with water heaters meeting Contract requirements and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial electric water heaters.
SECTION 15761 - HEATING AND COOLING COILS

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. Related Sections include the following:
   1. Division 15 Section “Mechanical General Requirements.”
   2. Division 15 Section “Basic Mechanical Materials and Methods.”

1.2 SUMMARY

A. This Section includes duct-mounted heating and cooling coils, and heating and cooling coils that are an integral part of air-handling units.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each coil. Include rated capacity and pressure drop for each coil.

B. Shop Drawings: Diagram power, signal, and control wiring.
C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which coil location and ceiling-mounted access panels are shown and coordinated with each other.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For air coils to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.

PART 2 - PRODUCTS

2.1 WATER COILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aerofin Corporation.
2. Carrier; a United Technologies Company.
3. Daikin Applied; a member of Daikin Industries, Ltd.
4. JCI/York International.
5. Luvata/Heatcraft Commercial/Industrial Products.
6. Precision Coils; a business of Unison Comfort Technologies.
7. Trane Inc.; a Division of Ingersoll Rand.

B. Performance Ratings: Tested and rated according to AHRI 410 and ASHRAE 33.

C. Minimum Working-Pressure/Temperature Ratings: 200 psig, 325 deg F.

D. Source Quality Control: Factory tested to 300 psig.
E. Tubes: ASTM B 743 copper, minimum 0.020 inch wall thickness, and minimum 0.50 inch diameter.

F. Fins: Aluminum, minimum 0.010 inch thick.

G. Headers: Cast iron with cleaning plugs, and drain and air vent tappings or seamless copper tube with brazed joints, prime coated.

H. Frames, Hot Water Coils: Galvanized-steel channel frame, minimum 0.0625 inch thick for flanged mounting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, plenums, and casings to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before coil installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install coils level and plumb.

B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

C. Hot Water Coils: Caulk and seal frame and all housing tube openings in the field with a non-hardening sealant. Sealant type shall be approved by the coil manufacturer.

D. Straighten bent fins on air coils.

E. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.
3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to coils to allow service and maintenance.

C. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Control valves are specified in Division 15 Section "Temperature Controls," and other piping specialties are specified in Division 15 Section "Hydronic Piping."

END OF SECTION 15761
SECTION 15815 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
1.2 SUMMARY
1.3 DEFINITIONS
1.4 SYSTEM DESCRIPTION
1.5 PERFORMANCE REQUIREMENTS
1.6 SUBMITTALS
1.7 QUALITY ASSURANCE
1.8 COORDINATION

PART 2 - PRODUCTS

2.1 MANUFACTURERS
2.2 SHEET METAL MATERIALS
2.3 DUCT LINER
2.4 SEALANTS AND GASKETS
2.5 HANGERS AND SUPPORTS
2.6 RECTANGULAR DUCT FABRICATION
2.7 APPLICATION OF LINER IN RECTANGULAR DUCTS
2.8 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

PART 3 - EXECUTION

3.1 DUCTWORK APPLICATION SCHEDULE
3.2 DUCTWORK APPLICATION SCHEDULE
3.3 DUCT INSTALLATION
3.4 INSTALLATION OF EXPOSED DUCTWORK
3.5 DUCT SEALING
3.6 HANGING AND SUPPORTING
3.7 CONNECTIONS
3.8 PAINTING
3.9 FIELD QUALITY CONTROL
3.10 START UP

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. Related Sections include the following:

1. Division 15 Section "Mechanical General Requirements."
3. Division 15 Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
4. Division 15 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 SUMMARY

A. This Section includes metal ducts for supply, return, outside, relief air, and exhaust air-distribution systems in pressure classes from minus 6- to plus 6-inch wg.

1.3 DEFINITIONS

A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain sizes inside lining.

B. Low Pressure: Up to 2 inch WG and velocities less than 1,500 fpm. Construct for 2 inch WG positive or negative static pressure.

C. Medium Pressure: Greater than 2 inch WG to 6 inch WG and velocities greater than 1,500 fpm and less than 2,500 fpm. Construct for 6 inch WG positive or negative static pressure.

D. High Pressure: Greater than 6 inch WG to 12 inch WG and velocities greater than 2,500 fpm. Construct for 12 inch WG positive or negative static pressure.

E. FRP: Fiberglass-reinforced plastic.

F. PVC: Polyvinyl Chloride.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. 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 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Application Schedule" Article.

1.6 SUBMITTALS

A. Shop Drawings: CAD-generated and drawn to 1/8 inch equals 1 foot scale. Show fabrication and installation details for metal ducts. Shop drawings shall be reviewed and approved by the Architect prior to any fabrication.

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Duct layout indicating sizes and pressure classes.
3. Elevations of top and bottom of ducts.
4. Dimensions of main duct runs from building grid lines.
5. Fittings.
6. Reinforcement and spacing.
7. Seam and joint construction.
8. Penetrations through fire-rated and other partitions.
9. Equipment installation based on equipment being used on Project.
10. Duct accessories, including access doors and panels.
11. Hangers and supports, including methods for duct and building attachment, vibration isolation.

B. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and
coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Other systems installed in same space as ducts.
3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Welding certificates.

E. Field quality-control test reports.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:


B. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."


1.8 COORDINATION

A. Sheet metal trades shall cooperate fully with the Laboratory Airflow Controls Trades and shall attend all field installation training sessions.
B. Sheet metal trades shall cooperate fully with the Test and Balance Contractor and provide all miscellaneous caps and any other materials required for structural integrity and leakage testing of the complete duct system in whole or in part. Refer to Division 15 Section "Testing, Adjusting and Balancing."

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

C. Sheet metal trades shall participate in the above ceiling coordination program. Refer to Division 01 requirements.

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. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

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. PVC-Coated Galvanized Steel: Acceptable by authorities having jurisdiction for use in fabricating ducts with UL 181, Class 1 listing. Lock-forming-quality, galvanized sheet steel complying with ASTM A 653/A 653M and having G60 coating designation. Factory-applied PVC coatings shall be 4 mils thick on exterior sheet metal surfaces of
ducts and fittings exposed to corrosive conditions and minimum 1 mil thick on interior surfaces.


F. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.

G. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

H. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

I. Tie Rods: For rectangular ducts having a side dimension of 48 inches or greater. Galvanized steel, 3/8-inch minimum diameter.

2.3 DUCT LINER

A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.

1. Manufacturers:
   a. CertainTeed Corp.; Insulation Group.
c. Knauf Fiber Glass GmbH.

2. Materials: ASTM C 1071, Type I, flexible; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.

a. Thickness: 1 inch.
b. Density: 1-1/2 pounds per cubic foot.
c. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
d. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
e. Maximum Operating Temperature: 250 deg F when tested according to ASTM C 411.
f. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
g. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

3. Noise reduction coefficient (NRC): Sound absorption coefficients shall not be less than those in the table below as tested by ASTM C423 using an ASTM E795 Type A mounting.

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<th>Thickness</th>
<th>125</th>
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2.4 SEALANTS AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Elastomeric Sealant Tape: 3 inches wide; modified butyl adhesive backed.
   
   1. Manufacturers:
      
      a. Hardcast; Foil-Grip 1402 and Foil-Grip 1402-181BFX.

C. Water-Based Joint and Seam Sealant:
   
   1. Manufacturers:
      
      a. Hardcast; Flex-Grip 550 and Versa-Grip 181.
      b. Polymer Adhesives; No. 11.
      c. United McGill.
      
   5. Water resistant.
   6. Mold and mildew resistant.
   7. VOC: Maximum 75 g/L (less water).
   8. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
   10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:
   
   1. Manufacturers:
      
      a. Hardcast; Sure-Grip 404.
      b. United McGill.
5. Solids Content: Minimum 60 percent.
7. Water resistant.
8. Mold and mildew resistant.
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.

E. Flanged Joint Sealant: Comply with ASTM C 920.
   2. Type: S.
   3. Grade: NS.
   5. Use: O.

F. Gaskets: Chloroprene elastomer, 40 durometer, 1/8 inch thick, full face, one piece vulcanized or dovetailed at joints.

G. Round Duct Joint O-Ring Seals:
   1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
   2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
   3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

2. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

3. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

4. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials. Attachments for stainless steel and PVC-coated duct shall be stainless steel.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.


3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

E. Load Rated Cable Suspension System for Noncorrosive Environments: Tested to five times the Safe Working Loads and verified by the SMACNA Testing and Research Institute.

1. Cable: Aircraft quality 7 x 7 and 7 x 19 wire rope.


2. Fastener: One-piece, die-cast zinc housing with Type 302 S26 stainless steel hardened and tempered springs, and oil impregnated, sintered, hardened and tempered steel locking wedges.
3. End Fixings: Loop, stud or toggle; or plain end suitable for wire rope beam clamp.

4. Manufacturers:
   b. Duro Dyne Corp.; Dyna-Tite System.

F. Stainless Steel Load Rated Cable Suspension System for Corrosive Environments: Tested to five times the Safe Working Loads and verified by the SMACNA Testing and Research Institute.

1. Cable: Aircraft quality stainless steel 7 x 7 and 7 x 19 wire rope.
   a. Stainless steel complying with ASTM A 492.

2. Fastener: One-piece, stainless steel housing with Type 302 S26 stainless steel hardened and tempered springs, and ceramic locking wedges.

3. End Fixings:
   a. Loop End: Type 316L/A4 stainless steel.
   b. Stud or Toggle End: Type 304L/A2 stainless steel.
   c. Plain end suitable for stainless steel wire rope beam clamp.

4. Manufacturers:
   b. Duro Dyne Corp.; Dyna-Tite System.

G. Welded Supports: Structural steel shapes with zinc rich paint. Equivalent, proprietary design, rolled steel structural support systems may be used in lieu of mill rolled structural steel.

2.6 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying 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 class.
2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
3. Internal Tie Rod: Ducts having a side dimension of 48 inches or greater only.

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's and SMACNA guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:
   a. Ductmate Industries, Inc.
   b. Nexus Inc.
   c. Ward Industries, Inc.

C. 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 nonbraced panel area unless ducts are lined.

2.7 APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and
standard liner product dimensions make longitudinal joints necessary.

F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm or greater.

G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

1. Fan discharges.
2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm or where indicated.

I. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

1. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

J. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.8 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

B. Round and Flat-Oval, Spiral Lock-Seam Ducts:

1. Manufacturers:
a. Eastern Sheet Metal (ESM).
b. LaPine Metal Products.
c. Lindab Inc.
e. SEMCO Incorporated.
f. SET Duct Manufacturing, Inc.
g. Tangent Air, Inc.
h. Universal Spiral Air.

C. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" or SMACNA "Industrial Duct Construction Standards" as required based on pressure class.

1. Round fittings shall be factory fabricated welded design. Use of field fabricated fittings (welded design) shall only be permitted when factory fabricated fittings are unavailable.

D. Flat-Oval, Spiral Lock-Seam Ducts: Fabricate supply ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" or SMACNA "Industrial Duct Construction Standards" as required based on pressure class.

1. Flat-oval fittings shall be factory fabricated welded design. Use of field fabricated fittings (welded design) shall only be permitted when factory fabricated fittings are unavailable.

E. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
4. Bolts and fasteners for galvanized steel duct shall be carbon steel, zinc coated per ASTM A153. Bolts and
fasteners for stainless steel and polyvinyl chloride coated steel duct shall be stainless steel.

5. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

   a. Manufacturers:

      1) AccuDuct Mfg. Inc.
      2) Ductmate Industries, Inc.
      3) Eastern Sheet Metal (ESM).
      4) Lindab Inc.
      5) Universal Spiral Air.

6. Flat-Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.

   a. Manufacturers:

      1) AccuDuct Mfg. Inc.
      2) Ductmate Industries, Inc.
      3) Eastern Sheet Metal (ESM).
      5) SEMCO Incorporated.
      6) Universal Spiral Air.

F. Low Pressure Ductwork (plus or minus 2 inches W.G. Static Pressure Class)

1. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible provide single thickness turning vanes.

2. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

G. Medium and High Pressure Ductwork (For Static Pressure Class Greater than plus or minus 2 inches W.G.)

1. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.
Where not possible provide single thickness turning vanes.
2. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.
3. Fabricate continuously welded medium and high pressure round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
4. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

H. 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 ducts.

I. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

J. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct 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 36 Inches in Diameter: 0.034 inch.
   b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
   c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
   d. 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 26 Inches in Diameter: 0.034 inch.
b. Ducts 27 to 50 Inches in Diameter: 0.040 inch.
c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
d. 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, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.

6. Round Elbows 8 Inches and Less in Diameter: 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 configurations or nonstandard diameter elbows with gored construction.

7. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.

8. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.

9. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-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 in Diameter and Pressures through 10-Inch wg: 0.022 inch.

K. PVC-Coated Elbows and Fittings: Fabricate elbows and fittings as follows:

1. Round Elbows 4 to 8 Inches in Diameter: Two piece, die stamped, with longitudinal seams spot welded, bonded, and painted with PVC aerosol spray.
2. Round Elbows 9 to 26 Inches in Diameter: Standing-seam construction.
3. Round Elbows 28 to 60 Inches in Diameter: Standard gored construction, riveted and bonded.
4. Other Fittings: Riveted and bonded joints.
5. Couplings: Slip-joint construction with a minimum 2-inch insertion length.

PART 3 - EXECUTION

3.1 DUCTWORK APPLICATION SCHEDULE

A. Ductwork materials and performance requirements are scheduled on the Drawing.

3.2 DUCTWORK APPLICATION SCHEDULE

A. Ductwork materials and performance requirements are scheduled on the Drawing.

3.3 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts 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 spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 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 dampers, and sleeves. Fire and smoke dampers are specified in Division 15 Section "Duct Accessories."

O. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.


1. Intermediate level.

3.4 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.5 DUCT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated. Ducts must be properly cleaned and sealed in strict accordance with sealant manufacturer’s instructions.

1. Seal Class: Refer to Application Schedule on the Drawings.
2. Seal ducts before external insulation is applied.
3. After pressure testing, remake leaking joints until leakage is equal to or less than maximum allowable. Refer to Application Schedule on the Drawings for allowable leakage rates.

3.6 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet and at each floor.

C. Install concrete inserts before placing concrete.

D. Support ductwork from building structure, not from roof deck, floor slab, pipe, other ducts, or equipment.
E. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

F. Use load rated cable suspension system for round duct in exposed locations.

3.7 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 15 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.9 FIELD QUALITY CONTROL

A. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

B. Duct system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 START UP

A. Air Balance: Comply with requirements in Division 15 Section "Testing, Adjusting, and Balancing."

END OF SECTION 15815
SECTION 15820 - 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.

B. Related Sections include the following:

1. Division 15 Section “Mechanical General Requirements.”
2. Division 15 Section “Testing, Adjusting, and Balancing” for duct test holes.
3. Division 15 Section “Temperature Controls” for motorized control dampers.
4. Division 16 Section “Fire Alarm” for duct-mounting fire and smoke detectors.
1.2 DEFINITIONS

A. NVLAP: National Voluntary Laboratory Accreditation Program.

B. Low Pressure: Up to 2 inch WG and velocities less than 1,500 fpm. Construct for 2 inch WG positive or negative static pressure.

C. Medium Pressure: Greater than 2 inch WG to 6 inch WG and velocities greater than 1,500 fpm and less than 2,500 fpm. Construct for 6 inch WG positive or negative static pressure.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For turning vanes, include data for pressure loss generated sound power levels.
2. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
c. Control damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Duct security bars.
f. 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.

D. Source quality-control reports.

E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE


B. Comply with AMCA 500-D testing for damper rating.

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 for each temperature rating.

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, Types 304 and 316 as indicated.

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.


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.

H. Tie Rods: Stainless steel, 1/4-inch diameter for lengths 36 inches or less; 3/8-inch diameter for lengths longer than 36 inches for use in ducts in humid or corrosive atmospheres.

I. Bird Screens: No. 2 mesh, 0.063 inch diameter galvanized wire screen with open area of not less than 72 percent. Conceal sharp edges by adding metal edging consisting of rod, flat or angle iron, or 16 gage galvanized sheet steel turned over at least 3/4 inch on both sides.

2.3 LOW PRESSURE MANUAL VOLUME DAMPERS

A. Manufacturers:
   1. American Warming and Ventilating.
   2. Arrow United Industries.
   5. Louvers and Dampers.
   6. Nailor Industries Inc.
   7. Ruskin Company.
   8. Vent Products Company, Inc.

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. Except for dampers in round ductwork sized 12 inches and smaller, provide end bearings.

C. Rectangular Volume Dampers: Multiple-opposed-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.

D. Round Volume Dampers 16-inch Diameter and Smaller: Single-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.

E. Round Volume Dampers Larger than 16-inch Diameter: Multiple-opposed-blade design AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.

F. Damper Materials:

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.


4. Bearings: Oil-impregnated bronze, molded synthetic, or stainless-steel sleeve type.

5. Tie Bars and Brackets: Galvanized steel.

G. Jackshaft: 1-inch-diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

H. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.4 TURNING VANES

A. Manufactured Turning Vanes:

1. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
2. Double-vane or airfoil-shaped, curved blades of galvanized sheet steel set into vane runners suitable for duct mounting.
3. Generated sound power level shall not exceed 54 decibels in octave band 4 at 2000 fpm in a 24-inch by 24-inch duct.
4. Manufacturers:
   b. Ductmate Industries, Inc.
   c. Duro Dyne Corp.
   d. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Acoustic Turning Vanes:

1. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
2. Double-vane curved blades of galvanized sheet steel with perforated faces and fibrous-glass fill set into vane runners suitable for duct mounting.
3. Manufacturers:
   a. Ductmate Industries, Inc.
   b. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
2.5 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class. Doors may be field fabricated in accordance with SMACNA Standards, or commercially produced.

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. Air Balance, Inc.
   b. Greenheck.
   c. Nailor Industries Inc.
   d. Ruskin Company.

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 compression 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.

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.

2.6 FLEXIBLE DUCTS, LOW AND MEDIUM PRESSURE

A. Manufacturers:

1. Flexmaster Type 8M, UL 181, Class 1.
3. Hart & Cooley.

B. Flexible Ducts: Interlocking spiral of galvanized steel or aluminum construction or fabric supported by helically wound spring steel wire or flat steel bands; rated to 6 inches WG positive and 4 inches WG negative for low and medium pressure ducts.

C. Insulated Flexible Ducts: Flexible duct wrapped with flexible glass fiber insulation, enclosed by a fire retardant polyethylene vapor barrier jacket; maximum 0.23 K value at 75 deg F.

D. Acoustical performance tested in accordance with the Air Diffusion Council's Flexible Air Duct Test Code FD 72-R1, Section 3.0, Sound Properties shall be as follows:

The insertion loss (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be minimum:

<table>
<thead>
<tr>
<th>Octave Band Hz.</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>250</th>
<th>500</th>
<th>1000</th>
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<tr>
<td>6&quot; diameter</td>
<td>8</td>
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<td>35</td>
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<td>25</td>
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<tr>
<td>8&quot; diameter</td>
<td>13</td>
<td>32</td>
<td>36</td>
<td>35</td>
<td>36</td>
<td>21</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>12&quot; diameter</td>
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<td>29</td>
<td>28</td>
<td>33</td>
<td>26</td>
<td>14</td>
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</table>

The radiated noise reduction (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be minimum:

<table>
<thead>
<tr>
<th>Octave Band Hz.</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
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<td>6&quot; diameter</td>
<td>6</td>
<td>8</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>13</td>
<td></td>
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</tr>
</tbody>
</table>
The self-generated sound power levels (LW) dB are 10-12 Watt of a 10 foot length of straight duct for an empty sheet metal duct when tested in accordance with ASTM E477, at a velocity of 1000 feet per minute, shall not exceed:

<table>
<thead>
<tr>
<th>Octave Band Hz.</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>6” diameter</td>
<td>42</td>
<td>31</td>
<td>23</td>
<td>18</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>8” diameter</td>
<td>41</td>
<td>34</td>
<td>27</td>
<td>19</td>
<td>18</td>
<td>21</td>
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<td>12” diameter</td>
<td>53</td>
<td>44</td>
<td>36</td>
<td>27</td>
<td>21</td>
<td>22</td>
</tr>
</tbody>
</table>

E. Flexible Duct Fittings: Galvanized steel, twist-in design with damper. Size as indicated.

F. 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.

2.7 FLEXIBLE DUCT ELBOW SUPPORTS

A. Manufacturer:

1. Automation Industries Thermaflex; FlexFlow Elbow.
2. Smart Air & Energy Solutions; SMART Flow Elbow.

B. Elbow supports shall be constructed of durable composite material and be fully adjustable to support flexible duct diameters 6 inches through 16 inches.

C. Elbow supports shall be UL listed for use in return air plenum spaces.

2.8 DUCT ACCESSORY HARDWARE

A. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.
2.9 finishes

A. Chemical Resistant Coating: P-403 manufactured by Heresite Chemical Company.

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 PVC coated ducts; and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install stainless steel volume dampers in stainless steel ducts.
3. Install aluminum volume dampers in aluminum ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On upstream side of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

7. Control devices requiring inspection.

8. Elsewhere as indicated.

F. Install access doors with swing against duct static pressure.

G. Install duct-mounting, rectangular access doors with long dimension at right angles to direction of airflow and of largest standard size which can be accommodated in duct. Maximum size: 21 by 14 inches.

H. Label access doors according to Division 15 Section "Mechanical Identification."

I. Connect flexible ducts to metal ducts with draw bands.

J. Install flexible duct elbow supports at each diffuser, grille, or register, and elsewhere as indicated.

K. Install turning vanes in rectangular duct elbows in excess of 45 degrees, and where indicated:

1. Use manufactured double-vane turning vanes unless otherwise specified.
2. Seat outboard-most vane in heal of duct elbow.
3. Provide vanes for all runner punchings; practice of eliminating every other vane is prohibited.
4. Use single-vane turning vanes in low pressure square elbows.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Inspect turning vanes for proper and secure installation.
4. Operate remote damper operators to verify full range of movement of operator and damper.

3.3 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Final positioning of manual-volume dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

END OF SECTION 15820
SECTION 15855 – DIFFUSERS, REGISTERS, AND GRILLES

PART 1 – GENERAL..................................................1
  1.1 RELATED DOCUMENTS........................................1
  1.2 SUBMITTALS..................................................1

PART 2 – PRODUCTS..................................................2
  2.1 AIR DIFFUSION DEVICES........................................2
  2.2 SOURCE QUALITY CONTROL...................................3

PART 3 – EXECUTION..................................................3
  3.1 EXAMINATION..................................................3
  3.2 INSTALLATION..................................................3
  3.3 ADJUSTING....................................................4

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. 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. Division 15 Section “Mechanical General Requirements.”
3. Division 15 Section "Duct Accessories" for volume-control dampers not integral to diffusers, registers, and grilles.

1.2 SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.
B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

PART 2 - PRODUCTS

2.1 AIR DIFFUSION DEVICES

A. Manufacturers: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Krueger; Tomkins PLC.
2. Nailor Industries of Texas Inc.
4. Titus; Tomkins PLC.

B. Terminal air diffusion devices have been chosen in terms of specific air distribution requirements, spacing, and sound characteristics.

C. Provide plaster frames for units installed in plaster ceilings.

D. Provide gaskets for supply terminal air devices mounted in finished surfaces.

E. Finish:

1. Air Diffusion Device Face and Visible Trim: Standard off white baked enamel finish unless noted otherwise.

F. Air pattern adjustments shall be made from the face of the device.
G. Refer to drawings and schedules for quantities, types, and finishes.

H. Coordinate frame types with Architectural Reflected Ceiling Plan.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."


PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Wall-Mounted Supply Registers: Install 6 inches below finished ceiling unless otherwise indicated.
D. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 15855
SECTION 15950 - TESTING, ADJUSTING, AND BALANCING

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.

B. Related Sections include the following:

1. Division 15 Section “Mechanical General Requirements.”
2. Division 15 Section “Basic Mechanical Materials and Methods.”
3. Division 15 Section “Common Work Results for HVAC.”

1.2 SUMMARY

A. This Section includes testing, adjusting, and balancing to produce design objectives for the following:

1. Air Systems:

   a. Constant-volume air systems.

2. Hydronic Piping Systems:

   a. Variable-flow systems.

3. HVAC equipment quantitative-performance settings.

4. Existing systems TAB.

5. Verifying that automatic control devices are functioning properly.

6. Reporting results of activities and procedures specified in this Section.

B. Include rebalancing of air systems, or system portions affected by recommended sheave changes.

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. AHJ: Authority having jurisdiction.

C. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

D. 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.

E. 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.

F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

G. Report Forms: Test data sheets for recording test data in logical order.

H. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

I. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

J. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

K. 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.

L. TAB: Testing, adjusting, and balancing.

M. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

N. Test: A procedure to determine quantitative performance of systems or equipment.

O. 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 2 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.


D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

E. Sample Report Forms: Submit two sets of sample TAB report forms.

F. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.

B. Smoke Control System Testing: Additional Qualifications: The TAB firm shall be a qualified special inspector for the smoke control systems. The TAB firm for the smoke control system shall have expertise in fire protection engineering, mechanical engineering, and certification as air balancers.

C. Approved Balancing Agencies.

1. The TAB firm selected shall be from the following list:

   a. Absolut Balance Company, Inc.; South Lyon, MI.
   b. Airflow Testing Inc.; Lincoln Park, MI.
   c. Barmatic Inspecting Co., Inc.; Lincoln Park, MI.
   d. Ener-Tech Testing; Holly, MI.
   e. Enviro-Aire/Total Balance Co.; St. Clair Shores, MI.
   f. International Test & Balance Inc.; Southfield, MI.

D. TAB Conference: Meet with Owner's and Architect'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.
   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.

E. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.


G. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

H. 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 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 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.

1.8 WARRANTY

A. National Project Performance Guarantee: If AABC standards are used, provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

B. Special Guarantee: If NEBB standards are used, provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.
PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. 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.

B. Examine system and equipment test reports.

C. 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.

D. 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.

E. Examine strainers for clean screens and proper perforations.

F. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

G. Examine system pumps to ensure absence of entrained air in the suction piping.

H. Examine equipment for installation and for properly operating safety interlocks and controls.

I. 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. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.

5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.

6. Sensors are located to sense only the intended conditions.

7. Sequence of operation for control modes is according to the Contract Documents.

8. Controller set points are set at indicated values.

9. Interlocked systems are operating.

10. Changeover from heating to cooling mode occurs according to indicated values.

J. 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. Perform the following field tests and inspections to new and renovated portions of duct systems according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes 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. Complete system readiness checks and prepare system readiness reports. Verify the following:
1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. 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" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. 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.

C. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts, or use reduced scale contract documents with notations.

C. For variable-air-volume systems, develop a plan to simulate diversity.
D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Cut insulation, and drill ducts for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes with neat patches, neoprene plugs, threaded plugs, or threaded twist-on metal caps, and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

F. Check air flow within intake plenums and mixing boxes of air handling units for uneven flow and temperature stratification and prepare a report with profile elevations (temperature and velocity) on each coil or filter face for Architect.

G. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

H. Verify that motor starters are equipped with properly sized thermal protection.

I. Check dampers for proper position to achieve desired airflow path.

J. Check for airflow blockages.

K. Check condensate drains for proper connections and functioning.

L. Check for proper sealing of air-handling unit components.

M. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

   a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from
restrictions in ducts such as elbows and transitions.

b. Measure static pressure directly at the fan outlet.

c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.

d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.

4. Select required sheave sizes and advise installing contractor to change drive sheaves accordingly. Refer to Division 15 Section “Common Work Results for HVAC” for additional requirements.

5. When existing air handling systems require rebalancing, select required sheave sizes and advise Mechanical Contractor to change drive sheaves accordingly. Refer to Division 15 Section “Common Work Results for HVAC” for additional requirements.

6. Do not recommend fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow at a point downstream from the balancing damper and adjust volume dampers until the proper airflow is achieved.

   a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

   1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

   1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

   2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate.

B. Prepare schematic diagrams of systems' "as-built" piping layouts, or use reduced scale contract documents with notations.
C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check expansion tank liquid level.
3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at indicated flow.
5. Set system controls so automatic valves are wide open to heat exchangers.
6. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

3.7 PROCEDURES FOR HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 5 percent of design.
B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
   1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
   1. Determine the balancing station with the highest percentage over indicated flow.
   2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
   3. Record settings and mark balancing devices.

F. Equipment installed with pressure independent characterized control valves (PICCV) or auto-flow devices shall not require hydronic system balancing unless multiple coils are served from a single PICCV or auto-flow device (Example: AHU coil banks with multiple coils). Measure flow through each PICCV and auto-flow device and compare measured value to scheduled value to verify proper valve/device was installed and valve is functional. Verify flow for 100 percent of PICCV and auto-flow devices. Report discrepancies.

G. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

H. Measure the differential-pressure control valve settings existing at the conclusions of balancing, and record in report.
3.8 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance variable-flow hydronic systems by following the “Proportional Balancing Procedure” in accordance with NEBB.

B. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.9 PROCEDURES FOR HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:
   1. Entering- and leaving-water temperature.
   2. Water flow rate.
   3. Water pressure drop.
   4. Dry-bulb temperature of entering and leaving air.
   5. Wet-bulb temperature of entering and leaving air for cooling coils.
   6. Airflow.
   7. Air pressure drop.

B. Refrigerant Coils: Measure the following data for each coil:
   1. Dry-bulb temperature of entering and leaving air.
   2. Wet-bulb temperature of entering and leaving air.
   3. Airflow.
   4. Air pressure drop.
   5. Refrigerant suction pressure and temperature.

3.10 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
   1. Measure and record the operating speed, airflow, and static pressure of each fan.
   2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
   3. Check the condition of filters.
   4. Check the condition of coils.
5. Check the operation of the drain pan and condensate drain trap.
6. Check bearings and other lubricated parts for proper lubrication.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
2. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
3. Air balance each air outlet.

3.11 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Air handling equipment and outlets: Plus or minus 5 percent.

   a. Where terminal units serve 6 or more outlets within a common room, individual outlets may vary up to plus or minus 10 percent of design flow.
rates if overall room supply is within plus or minus 5 percent.

2. Heating-Water Flow Rate: 0 to minus 10 percent.

3.12 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.

3.13 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. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. 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. Engineer's name and address.
7. Contractor's name and address.
9. Signature of TAB firm who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
   a. Indicated versus final performance.
   b. Notable characteristics of systems.
   c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. 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. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Water flow rates.
3. Terminal units.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:
   a. Unit identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Unit arrangement and class.
   g. Discharge arrangement.
   h. Sheave make, size in inches, and bore.
   i. Sheave dimensions, center-to-center, and amount of adjustments in inches.
   j. Number of belts, make, and size.
   k. Number of filters, type, and size.

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. Power factor efficiency.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Filter static-pressure differential in inches wg.
f. Preheat coil static-pressure differential in inches wg.
g. Cooling coil static-pressure differential in inches wg.
h. Heating coil static-pressure differential in inches wg.
i. Outside airflow in cfm.
j. Return airflow in cfm.
k. Outside-air damper position.
l. Return-air damper position.
m. Vortex damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:
   a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft.
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):
   a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outside-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and size.
   e. Manufacturer's serial number.
   f. Arrangement and class.
   g. Sheave make, size in inches, and bore.
   h. 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.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:
   a. System and air-handling unit number.
   b. Location and zone.
   c. Traverse air temperature in deg F.
   d. Duct static pressure in inches wg.
   e. Duct size in inches.
   f. Duct area in sq. ft..
   g. Indicated 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.

J. 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.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

   a. System and air-handling unit identification.
   b. Location and zone.
   c. Room or riser served.
   d. Coil make and size.
   e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

   a. Airflow rate in cfm.
   b. Entering-water temperature in deg F.
   c. Leaving-water temperature in deg F.
   d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:
   a. Unit identification.
   b. Location.
   c. Service.
   d. Make and size.
   e. Model and serial numbers.
   f. Water flow rate in gpm.
   g. Water pressure differential in feet of head or psig.
   h. Required net positive suction head in feet of head or psig.
   i. Pump rpm.
   j. Impeller diameter in inches.
   k. Motor make and frame size.
   l. Motor horsepower and rpm.
   m. Voltage at each connection.
   n. Amperage for each phase.
   o. Full-load amperage and service factor.
   p. Seal type.

2. Test Data (Indicated and Actual Values):
   a. Static head in feet of head or psig.
   b. Pump shutoff pressure in feet of head or psig.
   c. Actual impeller size in inches.
   d. Full-open flow rate in gpm.
   e. Full-open pressure in feet of head or psig.
   f. Final discharge pressure in feet of head or psig.
   g. Final suction pressure in feet of head or psig.
   h. Final total pressure in feet of head or psig.
   i. Final water flow rate in gpm.
   j. Voltage at each connection.
   k. Amperage for each phase.

3.14 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 Architect.

2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.

3. Architect 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.

3.15 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 15950
SECTION 16010 - ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL.................................................................2
  1.1 RELATED DOCUMENTS..........................................................2
  1.2 SUMMARY.............................................................................2
  1.3 REFERENCES........................................................................2
  1.4 QUALITY ASSURANCE............................................................2
  1.5 CODES, PERMITS AND FEES....................................................3
  1.6 DRAWINGS............................................................................4
  1.7 MATERIAL AND EQUIPMENT MANUFACTURERS............................5
  1.8 INSPECTION OF SITE...............................................................5
  1.9 ITEMS REQUIRING PRIOR APPROVAL.......................................6
  1.10 SHOP DRAWINGS/SUBMITTALS...............................................6
  1.11 COORDINATION DRAWINGS................................................7
  1.12 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS.......7
  1.13 RECORD DRAWINGS..............................................................8
  1.14 INSTRUCTION OF OWNER PERSONNEL...................................8
  1.15 WARRANTY...........................................................................9
  1.16 USE OF EQUIPMENT............................................................9
  1.17 COORDINATION.................................................................10

PART 2 - PRODUCTS (NOT APPLICABLE)............................................10

PART 3 - EXECUTION.................................................................10
  3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION........10
  3.2 DEMOLITION WORK................................................................11
  3.3 INSTALLATION OF EQUIPMENT...............................................12
  3.4 WORK IN EXISTING BUILDINGS...............................................13
  3.5 TEMPORARY SERVICES..........................................................13
  3.6 DISPOSAL.............................................................................13
  3.7 CHASES AND RECESSES.......................................................14
  3.8 CUTTING, PATCHING AND DAMAGE TO OTHER WORK.................14
  3.9 EXCAVATION AND BACKFILLING............................................15
  3.10 EQUIPMENT CONNECTIONS..................................................15
  3.11 CLEANING..........................................................................16
  3.12 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS....16
  3.13 EXTRA WORK.......................................................................16
  3.14 DRAWINGS AND MEASUREMENTS..........................................17
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 work of this section.

1.2 SUMMARY

A. This Section includes electrical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 1 Specification Sections.

1.3 REFERENCES

A. All materials shall be new. The electrical 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. A.N.S.I. - American National Standards Institute
2. A.S.T.M. - American Society for Testing Materials
3. I.C.E.A. - Insulated Cable Engineers Association
4. I.E.E.E. - Institute of Electrical and Electronics Engineers
5. N.E.C. - National Electrical Code
6. N.E.C.A. - National Electrical Contractors Association
7. N.E.M.A. - National Electrical Manufacturer's Association
8. U.L. - Underwriters Laboratories, Inc.

1.4 QUALITY ASSURANCE

A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the electrical systems as specified in the Division 16 Sections and as indicated on Drawings.
1. Contract Documents are complimentary, and what is required by one shall be as binding as if required by all. In the event of inconsistencies or disagreements within the Construction Documents bids shall be based on the most expensive combination of quality and quantity of the work indicated.

2. The Contractor understands that the work herein described shall be complete in every detail.

B. Ordinances and Codes: Perform all Work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of NFPA, NECA, and UL, unless otherwise indicated.

1. Notify the Architect/Engineer before submitting a 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.

C. Source Limitations: All equipment of the same or similar systems shall be by the same manufacturer.

D. Tests and Inspections: Perform all tests required by state, city, county and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.

E. 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.

F. 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 CODES, PERMITS AND FEES

A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for electrical work shall be secured and paid for by the Contractor. All
work shall conform to all applicable codes, rules and regulations.

B. Rules of local utility companies shall be complied with. Coordinate with the utility company supplying service to the installation and determine all devices including, but not limited to, all current and potential transformers, meter boxes, C.T. cabinets and meters which will be required and include the cost of all such items and all utilities costs in proposal.

C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed Drawings or diagrams which may be required by the governing authorities. Where the Drawings and/or Specifications indicate materials or construction in excess of code requirements, the Drawings and/or Specifications shall govern.

1.6 DRAWINGS

A. The Drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.

B. Examine the Drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.

C. Deviations from the Drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.

D. The architectural and structural 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. Where there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.
E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

1.7 MATERIAL AND EQUIPMENT MANUFACTURERS

A. All 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 electrical equipment and shall be of the manufacturer's latest design.

B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, electrical work, and building alterations shall be included in the original Bid. Similar equipment shall be by one manufacturer.

C. Where existing equipment is modified to include new switches, circuit breakers, metering or other components, the new components shall be by the original equipment manufacturer and shall be listed for installation in the existing equipment. Where original equipment manufacturer components are not available, third party aftermarket components shall be listed for the application and submitted to the engineer for approval. Reconditioned or salvaged components shall not be used unless specifically indicated on the drawings.

1.8 INSPECTION OF SITE

A. Visit the site, examine and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the
Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.

1.9 ITEMS REQUIRING PRIOR APPROVAL

A. Bids shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 1 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.

1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.

2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, electrical, replacement of other components, and building alterations shall be included in the original bid.

B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid.

1.10 SHOP DRAWINGS/SUBMITTALS

A. Submit project-specific submittals for review in compliance with Division 1.

B. All shop Drawings shall be submitted in groupings of similar and/or related items (lighting fixtures,
switchgear, etc.). Incomplete submittal groupings will be returned unchecked.

C. Provide detailed layout shop Drawings (on transparent media) of all lighting and power distribution systems, routing of conduits, combining of circuits, circuiting, details and related information necessary of installation and maintenance. After review by the Architect/Engineer, a copy of Drawings will be stamped and returned to the Contractor.

D. If deviations (not substitutions) from Contract Documents are deemed necessary by the Contractor, details of such deviations, including changes in related portions of the project and the reasons therefore, shall be submitted with the submittal for approval.

E. Submit for approval shop drawings for all electrical systems or equipment but not limited to the items listed below. Where items are referred to by symbolic designation on the Drawings and Specifications, all submittals shall bear the same designation (light fixtures). Refer to other sections of the electrical Specifications for additional requirements.

1. Wiring Devices
2. Lighting Control Devices
3. Panelboards
4. Dry Type Transformers (600 V and Less)
5. Fuses
6. Interior Lighting
7. Dimming Controls
8. Fire Alarm
9. School Intercom and Program Equipment
10. Public Address and Music Equipment

1.11 COORDINATION DRAWINGS

A. Submit project specific coordination drawings for review in compliance with Division 1 Specification Sections.

1.12 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS

A. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 1 Specification Sections.
B. Provide complete operation and maintenance instructional manuals covering all electrical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Four (4) copies of all literature shall be furnished for Owner and shall be bound in ring binder form. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

C. The operating and maintenance instructions shall include a brief, general description for all electrical systems including, but not limited to:

1. Routine maintenance procedures.
2. Trouble-shooting procedures.
3. Contractor's telephone numbers for warranty repair service.
5. Recommended spare parts lists.
6. Names and telephone numbers of major material suppliers and subcontractors.
7. System schematic drawings on 8-1/2" x 11" sheets.

1.13 RECORD DRAWINGS

A. Submit record drawings in compliance with Division 1.

B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media which have been neatly marked to represent as-built conditions for all new electrical work.

C. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer and Owner at their request.

1.14 INSTRUCTION OF OWNER PERSONNEL

A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of electrical equipment and systems at agreed upon times. A minimum of 8 hours of formal instruction to Owner's
personnel shall be provided for each building. Additional hours are specified in individual specification sections.

B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

C. In addition to individual equipment training provide overview of each electrical system. Utilize the as-built documents for this overview.

D. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction, or as requested by Owner.

1.15 WARRANTY

A. Warranty: Comply with the requirements in Division 1 Specification Sections. Contractor shall warranty that the electrical installation is free from defects and agrees to replace or repair, to the Owner’s satisfaction, any part of this electrical installation which becomes defective within a period of one year (unless specified otherwise in other Division 16 sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship or failure to follow the contract documents.

B. Contractor shall be responsible for any temporary services including equipment and installation required to maintain operation as a result of any equipment failure or defect during warranty period.

C. File with the Owner any and all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

1.16 USE OF EQUIPMENT

A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.
B. Do not use Owner's lamps for temporary lighting except as allowed and directed by the Owner. Equip lighting fixtures with new lamps when the project is turned over to the Owner.

1.17 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 DEMOLITION WORK

A. All demolition of existing electrical equipment and materials will be done by this Contractor unless otherwise indicated. Include all items such as, but not limited to, electrical equipment, devices, lighting fixtures, conduit, and wiring called out on the Drawings and as necessary whether such items are actually indicated on the Drawings or not in order to accomplish the installation of the specified new work.

B. In general, demolition work is indicated on the Drawings. However, the Contractor shall visit the job site to determine the full extent and character of this work.

C. Unless specifically noted to the contrary, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the appropriate trade for reuse. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Items on which the Owner waives ownership shall become the property of the Contractor, who shall remove and legally dispose of same, away from the premises.

D. Where equipment or fixtures are removed, outlets shall be properly blanked off, and conduits capped. After alterations are done, the entire installation shall present a "finished" look, as approved by the Architect/Engineer. The original function of the present electrical work to be modified shall not be changed unless
required by the specific revisions to the system as specified or as indicated.

E. Reroute signal wires, lighting and power wiring as required to maintain service. Where walls and ceilings are to be removed as shown on the Drawings, the conduit is to be cut off by the Electrical Trades so that the abandoned conduit in these walls and ceilings may be removed with the walls and ceilings by the Architectural Trades. All dead-end conduit runs shall be plugged at the remaining line outlet boxes or at the panels.

F. Where new walls and/or floors are installed which interfere with existing outlets, devices, etc., the Electrical Trades shall adjust, extend and reconnect such items as required to maintain continuity of same.

G. All electrical work in altered and unaltered areas shall be run concealed wherever possible. Use of surface raceway or exposed conduits will be permitted only where approved by the Architect/Engineer.

H. Existing lighting shall be reused where indicated on plans. Reused fixtures shall be detergent cleaned, relamped and reconditioned suitable for satisfactory operation and appearance.

3.3 INSTALLATION OF EQUIPMENT

A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the Drawings and Specifications, report such conflicts to the Architect/Engineer for resolution.

B. Device Location:

1. Allow for relocation prior to installation of wiring devices and other control devices, for example, receptacles, switches, fire alarm devices, and access control devices, within a 10-foot radius of indicated location without additional cost.
3.4 WORK IN EXISTING BUILDINGS

A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once Work is started in the existing building, shall complete same without interruption so as to return work areas as soon as possible to Owner.

B. Adequately protect and preserve all existing and newly installed Work. Promptly repair any damage to same at Contractor's expense.

C. Consult with the Owner’s Representative as to the methods of carrying on the Work so as not to interfere with the Owner's operation any more than absolutely necessary. Accordingly, all service lines shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Owner's Representative.

D. Prior to starting work in any area, obtain approval for doing so from a qualified representative of the Owner who is designated and authorized by the Owner to perform testing and abatement of all hazardous materials including but not limited to, asbestos. The Contractor shall not perform any inspection, testing, containment, removal or other work that is related in any way whatsoever to hazardous materials under the Contract.

3.5 TEMPORARY SERVICES

A. Provide and remove upon completion of the project, in accordance with the general conditions and as described in Division 1, a complete temporary electrical and telephone service during construction.

3.6 DISPOSAL

A. Fluorescent Lamps

1. Fluorescent lamps are known to contain mercury and are classified as hazardous material. All fluorescent lamps shall be assumed to contain mercury unless tested and confirmed otherwise with a toxicity characteristic leaching procedure (TCLP).
2. Hazardous materials (fluorescent lamps), shall be sent to a lamp recycling facility. The materials shall be properly packaged with labels that meet the Department of Transportation Regulations and stored in a secure location prior to transportation.

3. The Contractor shall identify the costs of the lamp disposal process including, but not limited to, the lamp packaging, storage, transportation, disposal, and any profile fees.

4. At the completion of the project, provide documentation to verify that the lamps have been properly disposed of in accordance with all local, state and federal guidelines.

B. Ballasts

1. Lighting ballasts manufactured prior to 1979 have been known to contain polychlorinated biphenyls (PCBs). Unless specifically noted on the ballast as containing "No PCBs," the ballast shall be assumed to contain components with PCB materials.

2. Hazardous materials (ballasts with PCBs), shall be disposed of at a hazardous waste incineration facility, or at a recycling facility in accordance with the Code of Federal Regulations as administered by the EPA in regards to this issue. The ballasts shall be packaged/stored in fifty-five gallon steel drums with labels that meet the Department of Transportation Regulations.

3. The Contractor shall identify the costs of the ballast disposal process including, but not limited to, the packaging, storage, transportation, disposal, and any profile fees.

4. Provide at completion of the project documentation (manifests) to verify that the ballasts have properly been disposed of in accordance with all local, state and federal guidelines.

3.7 CHASES AND RECESSES

A. Provided by the architectural trades, but the Contractor shall be responsible for their accurate location and size.

3.8 CUTTING, PATCHING AND DAMAGE TO OTHER WORK

A. Refer to General Conditions for requirements.
B. All cutting, patching and repair work shall be performed by the Contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

3.9 EXCAVATION AND BACKFILLING

A. Provide all excavation, trenching, tunneling, dewatering and backfilling required for the electrical work. Coordinate the work with other excavating and backfilling in the same area.

B. Where conduit is installed less than 2'6" below the surface of pavement, provide concrete encasement, 4" minimum coverage, all around or as shown on the electrical Drawings.

C. Backfill all excavations with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.

D. Backfill all excavations inside building, under drives and parking areas with well-tamped granular material. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.

E. Backfill outside building with granular material to a height 12 inches over top of pipe compacted to 95 percent compaction as specified above. Backfill remainder of excavation with unfrozen, excavated material in such a way to prevent settling.

3.10 EQUIPMENT CONNECTIONS

A. Make connections to equipment, motors, [elevator controllers, ]lighting fixtures, and other items included in the work in accordance with the approved shop Drawings and rough-in measurements furnished by the manufacturers
3.11 CLEANING

A. All debris shall be removed daily as required to maintain the work area in a neat, orderly condition.

B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

3.12 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS

A. Equipment and materials shall be protected from theft, injury or damage.

B. Protect conduit openings with temporary plugs or caps.

C. Provide adequate storage for all equipment and materials delivered to the job site. Location of the space will be designated by the Owner's representative or Architect/Engineer. Equipment set in place in unprotected areas must be provided with temporary protection.

3.13 EXTRA WORK

A. For any extra electrical work which may be proposed, this Contractor shall furnish to the General Contractor, an itemized breakdown of the estimated cost of the materials and labor required to complete this work. The Contractor shall proceed only after receiving a written order from the General Contractor establishing the agreed price and describing the work to be done. Prior to any extra work which may be proposed, the Electrical Contractor shall submit unit prices (same prices for increase/decrease of work) for the following items: 1/2", 3/4", 1", 1-1/2" conduit; #12, #10, #8, #6, #2 wire; receptacle, I.G. receptacle, data box, [V4000 wiremold, ]fire alarm combination visual/audible notification appliance, fire alarm visual notification appliance, clock, or other devices which may be required for any proposed extra work.
3.14 DRAWINGS AND MEASUREMENTS

A. The Drawings are not intended to be scaled for rough-in measurements nor to serve as Shop Drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement are the Contractor’s responsibility. The Contractor shall check latest Architectural Drawings and locate light switches from same where door swings are different from Electrical Drawings.

END OF SECTION 16010
SECTION 16060 - GROUNDING AND BONDING

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 grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

B. Related Sections include the following:

1. Division 16 Section “Electrical General Requirements”.
2. Division 16 Section “Conductors and Cables”.

1.3 REFERENCES

A. ASTM B 3: Specification for Soft or Annealed Copper Wire.
B. ASTM B 8: Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.

C. ASTM B 33: Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.


L. NFPA 70B: Recommended Practice for Electrical Equipment Maintenance.

M. NFPA 99: Health Care Facilities.


O. TIA/EIA 607: Commercial Building Grounding and Bonding Requirements Standard.

P. UL 96: Lightning Protection Components.

Q. UL 467: Grounding and Bonding Equipment.

R. UL 486 A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.

S. UL 486B: Wire Connectors for Use with Aluminum Conductors.
1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Data: For the following:
   1. Ground rods.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

D. Field Test Reports: Submit written test reports to include the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
   4. Indicate overall system resistance to ground.
   5. Indicate overall Telecommunications system resistance to ground.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 16 “Electrical General Requirements”.

B. Accurately record actual locations of grounding electrodes and connections to building steel.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Refer to specification section “Electrical Testing.”

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. Comply with UL 467.

C. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.
D. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

E. Comply with ANSI/TIA/EIA-607 “Standard for Commercial Building Grounding and Bonding Requirements for Telecommunications”.


PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grounding Conductors and Cables:
   a. Refer to Division 16 Section “Conductors and Cables”.

2. Mechanical Connectors:
   b. Burndy.
   c. Chance/Hubbell.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."

B. Material: Aluminum, copper-clad aluminum, and copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Grounding Electrode Conductors: Stranded cable.

E. Bare Copper Conductors: Comply with the following:


F. Copper Bonding Conductors: As follows:
1. Bonding Conductor: Stranded copper conductor; size per the NEC.
2. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; size per the NEC.
3. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; size per the NEC.

G. Aluminum Bonding Conductors: As follows:
   1. Bonding Conductor: Stranded aluminum conductor; size per the NEC.
   2. Bonding Jumper: Aluminum tape, braided bare aluminum conductors, terminated with aluminum ferrules; size per the NEC.

H. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS
A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
C. Compression-Type Connectors: Pure, wrought copper, per ASTM B187.

PART 3 - EXECUTION
3.1 EQUIPMENT GROUNDING
A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
B. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
C. In raceways, use insulated equipment grounding conductors.
D. Install equipment grounding conductors in all feeders and circuits. Terminate each end on suitable lugs, bus or bushing.

E. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

F. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

G. Verify specific equipment grounding requirements with the manufacturer’s recommendations.

3.2 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Equipment Grounding Conductor Terminations

1. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
2. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
C. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

D. Tighten screws and bolts for grounding and bonding 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.

E. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

F. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Install in conduit where routed above grade.

B. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
C. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

D. Separately Derived AC Power Systems: Ground separately-derived ac power system neutrals including distribution transformers to grounding electrodes per NFPA 70.

E. Equipment Grounding: Provide a permanent and continuous bonding of conductor enclosures, equipment frames, power distribution equipment ground busses, cable trays, metallic raceways, and other non-current carrying metallic parts of the electrical system.

END OF SECTION 16060
SECTION 16073 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Division 16 Section "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

2.3 ROOF MOUNTED CONDUIT AND EQUIPMENT SUPPORTS

PART 3 - EXECUTION

3.1 APPLICATION

3.2 SUPPORT INSTALLATION

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

3.4 CONCRETE BASES

3.5 PAINTING
FERNADELE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 15, 2018

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of \[ \text{five} \] times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

   1. Steel slotted support systems.
   2. Nonmetallic slotted support systems.

1.6 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
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 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.
   g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
4. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. Fabco Plastics Wholesale Limited.
   d. Seasafe, Inc.
2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.

3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.

4. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
2. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless] steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.


2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

2.3 ROOF MOUNTED CONDUIT AND EQUIPMENT SUPPORTS

A. General: Shop- or field- fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted conduit and equipment.
B. Adjustable Compact Stand: Recycled rubber base unit with integral threaded coupling capable of accepting 3/8-16 threaded rod, or 1-5/8 inch by 1-5/8 inch metal strut and various supporting elements.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
a. B-Line Systems, Inc.; a division of Cooper Industries; Dura-Blok.
b. ERICO International Corp.; Caddy Pyramid.
c. Tolco; a brand of Nibco; Pipe Piers.

C. Low-Type, Single-Conduit Stand: Assembly of base and horizontal members, and support, for roof installation without membrane penetration.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
a. B-Line Systems, Inc.; a division of Cooper Industries; Dura-Blok.
b. ERICO International Corp.; Caddy Pyramid.
c. Tolco; a brand of Nibco; Pipe Piers.

3. Horizontal Member: Cadmium-plated-steel or galvanized-steel strut designed for use with standard strut clamps and accessories.

D. Low-Type, Multiple-Conduit Stand: Assembly of two or more bases and horizontal members, and supports, for roof installation without membrane penetration.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
a. B-Line Systems, Inc.; a division of Cooper Industries; Dura-Blok.
b. ERICO International Corp.; Caddy Pyramid.
c. Tolco; a brand of Nibco; Pipe Piers.

3. Horizontal Member: Cadmium-plated-steel or galvanized-steel strut designed for use with threaded rod, standard strut clamps, and accessories.

E. High-Type, Multiple-Conduit and Equipment Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. B-Line Systems, Inc.; a division of Cooper Industries; Dura-Blok.
   b. ERICO International Corp.; Caddy Pyramid.
   c. Tolco; a brand of Nibco; Pipe Piers.

2. Bases: One or more recycled rubber.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with:
   a. Two-bolt conduit clamps
b. Single-bolt conduit clamps

c. Single-bolt conduit clamps using spring friction
   action for retention in support channel.

D. Spring-steel clamps designed for supporting single
   conduits without bolts may be used for 1-1/2-inch and
   smaller raceways serving branch circuits and communication
   systems above suspended ceilings and for fastening
   raceways to trapeze supports.

E. Support single runs of MC cable using spring-steel clamps
   from suspended ceiling hangers, hanger wire or building
   structure at intervals not to exceed three feet. Do not
   support MC cable from ceiling grid.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation
   requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described
   in NECA 1, EMT may be supported by openings through
   structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated,
   select sizes of components so strength will be adequate to
   carry present and future static loads within specified
   loading limits. Minimum static design load used for
   strength determination shall be weight of supported
   components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and
   Components: Anchor and fasten electrical items and their
   supports to building structural elements by the following
   methods unless otherwise indicated by code:

   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow
      masonry units and expansion anchor fasteners on solid
      masonry units.
   4. To Existing Concrete: Expansion anchor fasteners.
   5. Instead of expansion anchors, powder-actuated driven
      threaded studs provided with lock washers and nuts may
      be used in existing standard-weight concrete 4 inches
      thick or greater. Do not use for anchorage to
lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Steel:
   a. Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
   b. Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
   c. Spring-tension clamps.

7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel support systems attached to substrate.

E. Slotted support systems applications:
   1. Indoor dry and damp Locations: Painted Steel
   2. Outdoors and interior wet locations: Galvanized Steel
   3. Corrosive Environments, including pool equipment rooms: Nonmetallic

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

G. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

H. Obtain permission from Architect/Engineer before using powder-actuated anchors.

I. Obtain permission from Architect/Engineer before drilling or cutting structural members.

J. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

K. Install surface-mounted cabinets and panelboards with minimum of four anchors.

L. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.
M. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

N. The Contractor shall replace all 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 Architect/Engineer. All costs associated with replacing supports and steel channels shall be incurred by the Contractor.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Provide concrete bases for all floor mounted electrical equipment.

B. Base/Pad Construction:

1. Construct per manufacturer’s recommendations for particular equipment, including suggested piers and dowel rods.

2. Interior concrete bases shall have a minimum depth of 4” unless other indicated or recommended by the manufacturer.

3. Exterior concrete bases shall have a minimum depth of 8” unless other indicated or recommended by the manufacturer.

4. Construct concrete bases for primary and secondary power distribution equipment per requirements of the electrical utility, where submitted for its review.

C. Anchor equipment to base per both supports and equipment manufacturer’s instructions.
D. Coordinate conduit openings and sleeve locations in base with requirements of equipment to be supported.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of the base.
2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.
SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

1.3 QUALITY ASSURANCE

1.4 COORDINATION

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

2.2 CONDUCTOR, COMMUNICATION AND CONTROL CABLE IDENTIFICATION MATERIALS

2.3 WARNING LABELS AND SIGNS

2.4 INSTRUCTION SIGNS

2.5 EQUIPMENT IDENTIFICATION LABELS

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

2.7 WIRING DEVICE IDENTIFICATION

PART 3 - EXECUTION

3.1 APPLICATION

3.2 INSTALLATION

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 the following:

1. Identification for raceway and metal-clad cable.
2. Identification for conductors.
3. Warning labels and signs.
4. Instruction signs.
5. Equipment identification labels.

1.3 QUALITY ASSURANCE

B. Comply with NFPA 70.


1.4 COORDINATION


B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power Circuits: Black letters on an orange field.
2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
2.2 CONDUCTOR, COMMUNICATION AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.3 WARNING LABELS AND SIGNS


B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.4 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background. Minimum letter height shall be 3/8 inch (10 mm).
2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
   2. Tensile Strength: 50 lb, minimum.
   3. Temperature Range: Minus 40 to plus 185 deg F.

B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.7 WIRING DEVICE IDENTIFICATION

A. Description: Self-adhesive label with black upper case letters on clear polyester label, font size 7.

PART 3 - EXECUTION

3.1 APPLICATION

A. Accessible Raceways and Metal-Clad Cables More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches high, with self-adhesive vinyl labels. Repeat legend at 10-foot maximum intervals.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service and Feeders More Than 400 A: Identify with orange self-adhesive vinyl label.

C. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
   1. Fire Alarm System: Red.
   2. Control Wiring: Green and red.

D. Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape and marker tape. Identify source and circuit number.
of each set of conductors. For single conductor cables, identify phase in addition to the above.

E. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number as indicated on Drawings. Identify control circuits by control wire number as indicated on shop drawings.

F. Branch-Circuit Conductor Identification: Mark junction box covers in indelible ink with the panel and breaker numbers of other circuits contained within.

G. Conductor Identification: Locate at each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection or termination point.


1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.


I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

   a. Power transfer switches.

   b. Controls with external control power connections.
2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

J. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Engraved, laminated acrylic or melamine label mechanically secured.
   b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled: If included on project. All items may not be on project.

   a. Panelboards, electrical cabinets, and enclosures.
   b. Access doors and panels for concealed electrical items.
   c. Transformers.
   d. Disconnect switches.
   e. Enclosed circuit breakers.
   f. Motor starters.
   g. Power transfer equipment.
   h. Contactors.
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 15, 2018

i. Remote-controlled switches, dimmer modules, and control devices.

j. Intercommunication and call system master and staff stations.

k. Television/audio components, racks, and controls.

l. Fire-alarm control panel and annunciators.

m. Breakers or switches at distribution panels.

L. Wiring Device Identification Labels: On each faceplate install circuit designation label that is consistent with panelboard directories, and as-built plan drawings. Apply labels to receptacle faceplates centered below bottom outlet. Apply labels to toggle switch faceplates on backside.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location:

1. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

2. Conduit Markers: Provide identification for each power conduit containing conductors rated 400A or greater.

C. Apply identification devices to surfaces after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot
maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.

2. Colors for 208/120-V Circuits:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.

3. Colors for 480/277-V Circuits:
   b. Phase B: Orange.
   c. Phase C: Yellow.

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Label information arrangement for 3 lines of text.

1. Line one shall describe the panel or equipment. Line one example: “DP-XX,” “RP-XX,” “T-XX,” “EF-XX,” etc.

2. Line two shall describe the first disconnecting means feeding this panel or equipment. Line two example: “Fed from DP-XX,” “Fed from RP-XX,” etc.

3. Line three indicates that location of the disconnecting means as identified in line two. Line three example: “First Floor Elect. Rm #XXX.”

4. Line four shall include “Via T-XX” when panel or equipment is fed from a transformer.

I. Examples:

<table>
<thead>
<tr>
<th>RP-1A</th>
<th>EF-1</th>
<th>LP-1A</th>
</tr>
</thead>
</table>

ELECTRICAL IDENTIFICATION 16075 - 8
FERNADALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 JANUARY 15, 2018

<table>
<thead>
<tr>
<th>FED FROM DP-1A ELECTRICAL ROOM A100 VIA T-1A</th>
<th>FED FROM MCC-1A MECHANICAL ROOM F101</th>
<th>LOCATED IN ELECTRICAL ROOM A100</th>
</tr>
</thead>
</table>

J. Fusible Enclosed Switches and Distribution Equipment: Install self-adhesive vinyl label indicating fuse rating and type on the outside of door on each fused switch.

K. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.

L. Degrease and clean surface to receive nameplates.

M. Install nameplate and labels parallel to equipment lines.

N. Secure nameplate to equipment front using screws.

O. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

P. Identify conduit using field painting where required.

Q. Paint red colored band on each fire alarm conduit and junction box.

R. Paint bands 10 feet on center, and 4 inches minimum in width.

END OF SECTION 16075
SECTION 16120 - CONDUCTORS AND CABLES

PART 1 - GENERAL........................................1
  1.1 RELATED DOCUMENTS..................................1
  1.2 SUMMARY...........................................1
  1.3 SUBMITTALS........................................1
  1.4 QUALITY ASSURANCE.................................2

PART 2 - PRODUCTS........................................2
  2.1 MANUFACTURERS....................................2
  2.2 CONDUCTORS AND CABLES...........................2
  2.3 CONNECTORS AND SPLICES...........................3

PART 3 - EXECUTION........................................3
  3.1 CONDUCTOR AND INSULATION APPLICATIONS..........3
  3.2 INSTALLATION.......................................5
  3.3 CONNECTIONS........................................6
  3.4 FIELD QUALITY CONTROL............................7

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 building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

B. Related Sections include the following:

1. Division 16 Section "Control/Signal Transmission Media" for transmission media used for control and signal circuits.
2. Division 16 Section "Electrical Identification" for conductor and cable color-coding.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Qualification Data: For testing agency.

C. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

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 CONDUCTORS AND CABLES

A. Manufacturers, Copper:

1. Triangle.
2. Royal.
4. General Cable Corporation.
5. Southwire Company.
6. Draka USA.
B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

C. Conductor Material: Copper.

D. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

E. Conductor Insulation Types: Type THHN-THWN and XHHW complying with NEMA WC 70.

F. Multi-conductor Cable: Metal-clad cable, Type MC with ground wire.

G. Power Cable for Variable Frequency Controlled Motors: 600V and 2000V, three conductors, XLPE cable with three symmetrical positioned ground conductors and a continuous impervious corrugated aluminum armor and overall PVC jacket. Cable shield transfer impedance shall be less than 10 ohms per meter up to 30 MHz when tested in accordance with NEMA WC 61.

1. Approved manufacturers for VFC power cables:
   a. Southwire Armor-x
   b. Draka USA

2.3 CONNECTORS AND SPLICES

A. Manufacturers:
   1. AFC Cable Systems, Inc.
   2. AMP Incorporated/Tyco International.
   3. Hubbell/Anderson.
   4. O-Z/Gedney; EGS Electrical Group LLC.
   5. 3M Company; Electrical Products Division.
   6. T & B.
   7. Burndy.
   8. ILSCO.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance: Type XHHW, single conductors in raceway.
B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Exposed Feeders #4/0 and larger: Type XHHW, single conductor in raceway.

D. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

E. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspace: Type THHN-THWN, single conductors in raceway.

F. Exposed Branch Circuits, including in Crawlspace: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway and metal-clad cable, Type MC, for branch circuit drops to devices and within partition walls. MC cable shall not be run in ceiling space in lengths greater than 6’-0”.

H. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.

I. Underground Feeders and Branch Circuits: XHHW single conductors in conduit.

J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.

K. Fire Alarm Circuits: Type THHN-THWN, in raceway or Power-limited, fire-protective, signaling circuit cable.

L. Class 1 Control Circuits: Type THHN-THWN, in raceway.

M. Class 2 Control Circuits: Type THHN-THWN, in raceway.

N. Critical Fire Control Circuits: Type RHH, single conductor in raceway. UL classified with two hour fire rating when installed in EMT conduit per the NEC and UL electrical circuit protective system (FHIT) #25 of the UL fire resistance directory. Support every 5’ on center.

O. Variable Speed Drives to Motors: Use VFD power cable manufactured by Southwire or Draka. Support every 5’ on center.
3.2 INSTALLATION

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Basic Electrical Materials and Methods."

F. Seal around cables penetrating fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."

G. Each feeder shall be of the same conductor and insulation material (phase, neutral, and parallel).

H. Identify and color-code conductors and cables according to Division 26 Section "Electrical Identification."

I. All wiring shall be installed in conduit or approved raceway. All raceways shall be provided with a ground conductor unless noted otherwise on the Contract Documents.

J. Use conductor not smaller than 12 AWG for power and lighting circuits. Unless indicated otherwise, all circuits shall be 2#12, 1#12G, ¾"C. Do not share neutrals.

K. Use conductor not smaller than 14 AWG for control circuits, provided by Electrical Contractor.

L. Support communication cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.

M. Use suitable cable fittings and connectors.
N. Neatly train and lace wiring inside boxes, equipment, and panelboards.

O. Clean conductor surfaces before installing lugs and connectors.

P. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

Q. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.

R. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

S. Branch circuits may be combined up to 6 circuits in a homerun conduit. Electrical Contractor shall be responsible for derating of conductors as required by N.E.C. Do not share neutrals.

T. Use piercing connector with insulating covers for conductor splices and taps, 8 AWG and larger.

U. Where the armor of type AC cable terminates, a fitting shall be provided to protect the wiring from abrasion. An approved bushing shall be provided between the conductors and the armor.

V. Type MC cable shall be supported and secured at intervals not exceeding 4'-0".

W. Fittings used for MC cable shall be identified for such use.

X. AC/MC cable shall not be used for home runs to receptacle or distribution panels.

Y. Between support, hangers and termination no more than 3" deflection from the bottom of the cable to a horizontal line between the support/hanger or termination.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality control tests in accordance with Division 26 section “Electrical Testing”

   1. Description: Test all feeders rated 100 A and above.

   2. Visual and Mechanical Inspection

      a. Inspect cables for physical damage and proper connection in accordance with the one line diagram.

      b. Test cable mechanical connections with an infrared survey.

      c. Check cable color-coding against project Specifications and N.E.C. requirements.

3. Electrical Tests

   a. Perform insulation resistance test on each conductor with respect to ground and adjacent conductors. Applied potential to be 1000 volts dc for 1 minute.

   b. Perform continuity test to insure proper cable connection.

4. Test Values

   a. Minimum insulation resistance values shall be not less than fifty mega-ohms.

B. Test Reports: Prepare a written report to record the following:

   1. Test procedures used.

   2. Test results that comply with requirements.

   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
SECTION 16130 - RACEWAYS AND BOXES

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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 16 Section, “Basic Electrical Materials and Methods” for exterior duct banks, manholes, and underground utility construction.
2. Division 7 Section, "Through-Penetration Firestop Systems"

3. Division 16 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings, and for access floor boxes and service poles.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.
B. ENT: Electrical nonmetallic tubing.
C. FMC: Flexible metal conduit.
D. IMC: Intermediate metal conduit.
E. LFMC: Liquidtight flexible metal conduit.
F. LFNC: Liquidtight flexible nonmetallic conduit.
G. RNC: Rigid nonmetallic conduit.
H. PVC: Polyvinyl Chloride.
I. HDPE: High Density Polyethylene.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Manufacturer Seismic Qualification Certification: Submit certification that enclosures, cabinets, accessories, and components will withstand seismic forces defined in Division 26 Section "Electrical Supports and Seismic Restraints." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

   b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and
the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. All work in natatorium/pool area shall be in accordance with N.E.C. article 680, "Swimming Pools, Fountains, and Similar Installations."

1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

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 METAL CONDUIT AND TUBING

A. Manufacturers:
1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube Triangle Century.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. International Metal Hose.
6. Electri-Flex Co
7. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
8. LTV Steel Tubular Products Company - Manhattan/CDT/Cole-Flex.
11. Wheatland.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. EMT and Fittings: ANSI C80.3.
   1. Fittings: Steel set-screw type.
   E. LFMC: Flexible steel conduit with PVC jacket.
   F. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 FIRE ALARM EMT

A. Manufacturers:
   1. Allied Tube Triangle Century.
   B. EMT conduit with bright red topcoat; Fire Alarm EMT.
   C. EMT and Fittings: ANSI C80.3.

2.4 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:
   2. Anamet Electrical, Inc.; Anaconda Metal Hose.
   3. Arnco Corp.
   4. Cantex Inc.
7. ElecSys, Inc.
8. Electri-Flex Co.
9. Integral.
10. Kor-Kap.
12. Manhattan/CDT/Cole-Flex.
13. RACO; Division of Hubbell, Inc.
15. Spiralduct, Inc./AFC Cable Systems, Inc.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.

D. ENT and RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

E. LFNC: UL 1660.


2.5 METAL WIREWAYS

A. Manufacturers:
   1. Hoffman.
   2. Square D.

B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

E. Wireway Covers: Hinged type.

F. Finish: Manufacturer's standard enamel finish.
2.6 NONMETALLIC WIREWAYS

A. Manufacturers:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

B. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

C. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

E. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.7 SURFACE RACEWAYS

A. Surface raceway (Wiremold – ivory color) shall be used in finished areas. Do not use EMT conduit in finished areas unless directed by the Architect.

B. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating and ivory finish.

1. Manufacturers:

   c. Wiremold Company (The); Electrical Sales Division.

C. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.
2.8 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Shall be used within walls or ceiling.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover. Shall be used in all exposed, non-recessed, locations.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2. Shall be used in corrosive areas.

D. Floor Boxes: Cast metal, fully adjustable, rectangular.

E. Floor Boxes: Nonmetallic, nonadjustable, round.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover. Shall be used in areas exposed to water.

H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

I. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.9 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

B. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
FERNDALE HS-KITCHEN/SERVING LINE
AND CAFETERIA RENOVATION 171745 January 15, 2018

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors Applications:

1. Exposed: Rigid steel or IMC.
2. Concealed: Rigid steel or IMC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R.

B. Indoor Applications:

1. Exposed, Not Subject to Physical Damage in non-finished areas: EMT.
2. Exposed, Not Subject to Severe Physical Damage in non-finished areas: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit up to 10’-0” above finished floor. Includes raceways in the following locations:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: IMC.
7. Raceways Embedded in Concrete Above Grade: EMT or Rigid Steel.
8. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
9. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
10. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
11. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. Rigid Steel Conduits: Use only fittings approved for use with that material.
3. EMT Conduits: Use steel set-screw fittings.

E. Do not install aluminum conduits embedded in or in contact with concrete.

3.2 INSTALLATION

A. Install conduit in accordance with NECA “National Electrical Installation Standards”.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Install temporary closures to prevent foreign matter from entering raceways.

F. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

G. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

H. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

I. Raceways Embedded in Slabs:

1. Raceways embedded in slabs shall be limited to above grade concrete decks. Embedded conduit shall be limited to servicing floor boxes and equipment located in open spaces away from accessible walls.
2. Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover.
3. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
4. Space raceways laterally to prevent voids in concrete.
5. Run conduit larger than 1-inch trade size (DN 27) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
6. Conduits shall run flat. Do not allow conduits to cross.

J. Raceways installed under slab on grade: Use Schedule 40 nonmetallic conduit with rigid steel conduit sweeps, route conduits a minimum of 6” below bottom of slab.

K. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.
2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

L. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors.

M. Tighten set screws of threadless fittings with suitable tools.

N. Terminations:
1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.

2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

P. Provide pull string and 25% spare capacity in every branch circuit conduit.

Q. Telephone and Signal System Raceways, 2-Inch Trade Size (DN 53) and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

1. Electrical condulet (LB’s) are not permitted.

2. Conduits shall have no more than two 90 degree bends between pull points or pull boxes.

3. Conduits shall contain no continuous sections longer than 100 ft. without a pull point/box.

4. The bend radius of conduit must be at least 6 times the internal diameter for a conduit 2 inches or less and a radius of 10 times the diameter for a conduit greater than two inches.

5. All conduit ends shall have an insulated bushing.

R. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where otherwise required by NFPA 70.
S. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

T. Flexible Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

U. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

V. Set floor boxes level and flush with finished floor surface.

W. Set floor boxes level. Trim after installation to fit flush with finished floor surface.

X. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

Y. Do not route feeders across roof.

Z. Provide a pull box (a handhole for outdoor applications) for each conduit run that exceeds 250 feet. Provide two pull boxes (handholes for outdoor applications) for runs that exceed 500 feet.

AA. Conduit run in natatorium/pool area shall be EMT with compression fittings, and painted by the painting contractor (corrosion treatment paint per Architect’s requirements).

BB. Provide bonding of the pool structure/equipment per N.E.C. article 680-22. Coordinate with the pool contractor.

CC. Route conduits in finished areas with exposed ceilings at underside of structural deck or as high as possible.
DD. Conduits that route through, to, or from a hazardous classified space (Class I or II) shall have proper seal offs when exiting or entering the hazardous classified space.

EE. Outlet boxes within hazardous locations shall be of the proper class and division as noted in the N.E.C.

FF. Offset outlet boxes on opposite sides of common walls to prevent sound transmission between adjoining rooms.

GG. Firestop raceways passing through rated walls and floors in accordance with Division 07 specifications. See architectural drawings for locations of rated assemblies.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.
SECTION 16140 - WIRING DEVICES

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 the following:

1. Single and duplex receptacles, ground-fault circuit interrupters, integral surge suppression units, and isolated-ground receptacles.
3. Device wall plates.
4. Pin and sleeve connectors and receptacles.
5. Floor service fittings, poke-through assemblies, access floor boxes, and service poles.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter.
C. PVC: Polyvinyl chloride.
D. RFI: Radio-frequency interference.
E. TVSS: Transient voltage surge suppressor.
F. UTP: Unshielded twisted pair.

1.4 REFERENCES

D. NEMA FB 11: Plugs, Receptacles, and Connectors of the Pin and Sleeve Type for Hazardous Locations.
E. NEMA WD 1: General Requirements for Wiring Devices.
F. NEMA WD 6: Wiring Device - Dimensional Requirements.
G. UL 20: General-Use Snap Switches.
H. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
I. UL 486B: Wire Connectors for Use with Aluminum Conductors.
J. UL 498: Electrical Attachment Plugs and Receptacles.
K. UL 943: Ground Fault Circuit Interrupters.
1.5 SUBMITTALS

A. Product Data: Provide manufacturer’s catalog information showing dimensions, colors, and configurations for each type of product indicated.

B. Qualification Data: For testing agency.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency’s Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

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

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 70.

1.7 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

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 RECEPTACLES

A. All receptacles shall be tamper resistant (adjust model numbers listed below as required).

B. Straight-Blade and Locking Receptacles: Heavy-Duty grade.

C. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498. Configuration 5-20R duplex receptacle.

1. Manufacturers:
   a. Hubbell Incorporated; Wiring Device-Kellems HBL 5362.

D. Self-Test GFCI’s: Duplex GFCI Convenience Receptacles, 125 V, 20 A. Comply with NEMA WD1, NEMA WD6 configuration 5-20R, UL 498, Federal Specification W-C-596 and UL 943, Class A, and include indicator light that is lighted when device is tripped. Must have self-test feature and SafeLock protection™: conducts an automatic test every second, ensuring its always ready to protect. If the device fails the self-test, the indicator light flashes to signal that the GFCI should be replaced. With SafeLock Protection™, if critical components are damaged and ground fault protection is lost, power to receptacle must be discontinued.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work, include, but are not limited to the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Pass & Seymour/Legrand; Wiring Devices Division: 2096.
   b. Hubbell equal.

E. Industrial Heavy-Duty Pin and Sleeve Devices: Comply with IEC 309-1.

F. Hazardous (Classified) Location Receptacles: Comply with NEMA FB 11.
2.3 WALL SWITCHES

A. Manufacturers:

1. Hubbell Incorporated; Wiring Device-Kellems 1220 Series.

B. Device body: Plastic toggle handle.


D. Provide single-pole, two-pole, three-way and four-way switches as indicated.

E. Provide pilot light where indicated.

F. Provide key type where indicated. Furnish a minimum of six keys to Owner.

1. Switch shall be Hubbell 1220 series (or equal as specified above) with locking coverplate.
2. Coverplate shall be Hubbell HBL96062, straight keyed cylinder type lock, with stainless steel finish.

G. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.

2. Receptacle: NEMA WD 6, Configuration 5-20R.

2.4 DIGITAL TIME SWITCHES

A. General:

1. Watt Stopper TS-400 or equal. Operation on 100 to 300 volts.
2. Digital time switch turns lights off automatically after pre-set time. Pushbutton operation with time setting from 5 minutes to 12 hours.

2.5 DIMMER SWITCHES

A. General:
1. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.
2. Dimmer switches shall provide full-range, variable control of light intensity utilizing a continuous Square Law dimming curve.
3. Provide protected memory during temporary power failures that restores lights to same level of intensity set prior to power interruption.
4. Provide dimmer switches UL listed for the type of load being served (incandescent, fluorescent, magnetic low voltage transformer, electronic low voltage transformer). Universal load-type dimmer switches shall not be acceptable.
5. Provide dimmers that provide no adverse effects on other components of the electrical system being served (low voltage transformers, ballasts, lamps, etc.).

B. Incandescent Lamp Dimmers:

1. Manufacturers:
   a. Lutron Model N-2000-W.
   b. Leviton Model 82000-W.
   c. Hubbell equal.

2. Modular, 120 V, 60 Hz with continuously adjustable control; single pole with soft tap or other quiet switch; and 5-inch wire connecting leads.

3. Dimmer switches serving magnetic low voltage transformers shall be designed to control and provide a symmetrical ac waveform to the input of the magnetic low voltage transformer and not cause the transformer to operate above its rated operating current or temperature.

4. Dimmer switches serving solid-state low-voltage transformers shall not affect the sound rating of the transformer and not cause lamp flicker at any point in the dimming range.

5. Control: Continuously adjustable slider with slide-to-off; with single-pole or three-way switching to suit connections.


C. Fluorescent Lamp Dimmer Switches:
1. Manufacturers:
   a. Hubbell Incorporated; Wiring Device-Kellems
   b. Lutron.
   c. Leviton.

2. Modular; single-pole, compatible with electronic dimming ballast provided with fluorescent light fixtures and rated for the specified load and voltage; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

3. Control: Continuously adjustable slider with pre-set; single-pole or three-way switching to suit connections.

4. Power rating: 1200 W.

2.6 WALL PLATES

A. Manufacturers:

1. Provide wall plates and corresponding wiring devices from same manufacturer.

B. Single and combination types to match corresponding wiring devices.

   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: 0.035-inch- thick, satin-finished stainless steel.
   4. Material for Wet Locations: Gasketed Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

      a. Manufacturers:

         1) Red Dot Model CKSGV (cast aluminum), Thomas & Betts.

2.7 FLOOR SERVICE FITTINGS

A. Manufacturers:

1. Wiremold.
B. Type: Modular, fully adjustable recessed-type, with services indicated suitable for wiring method used.

C. Compartments: Provide barrier separating power from telecommunications cabling. Provide recessed-type floor service fittings with independent compartments and feed through wiring capability.

D. Service Plate: Provide service plate type as indicated. Provide protective ring for flush service plates.

E. Power Receptacle(s): NEMA WD 6, Configuration 5-20R Heavy-duty grade duplex receptacle, black finish, unless otherwise indicated.

F. Telecommunications Outlet: Blank cover with bushed cable opening.

2.8 FINISHES

A. Color:

1. Wiring Devices Connected to Normal Power System: White at each school, unless otherwise indicated or required by NFPA 70.
3. Wall Switches: White, unless otherwise indicated.
4. Dimmer Switches: White, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer’s instructions.

B. Prior to installation of devices, verify wall openings are neatly cut and will be completely covered by wall plates, clean debris from outlet boxes and provide extension rings to bring outlet boxes flush with finished surface.

C. Install devices and assemblies level, plumb, and square with building lines.
D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging according to manufacturer's written instructions.

E. Arrangement of Devices:

1. Coordinate locations of outlet boxes provided under Division 26 Section “Raceways and Boxes” to obtain mounting heights indicated on Drawings.
2. Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top.
3. Where multiple switches, dimmers, and/or occupancy sensors are adjacent to each other, provide a single cover plate. Custom fabricate, if required, for all combinations. Provide separate boxes or barriers as required for the application.
4. Install horizontally mounted receptacles with grounding pole on the left.
5. Install GFCI receptacles so that the “Push To Test” and “Reset” designations can be read correctly. If printed in both directions, install with ground pole on top.
6. Install switches with OFF position down.

F. Install cover plates on switch, receptacle, and blank outlets in finished areas.

G. Use oversized plates for outlets installed in masonry walls.

H. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

I. Remove wall plates and protect devices and assemblies during painting.

J. Coordinate installation of access floor boxes with access floor system provided by Architectural trades.

K. Install properly oriented access floor boxes into cutouts in access floor tiles and secure to tiles per Manufacturer’s instructions.

L. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
M. Adjust devices and wall plates to be flush and level. Three corners of wall plates must be in contact with wall surfaces. Devices shall be solidly mounted against the box.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use adhesive label as specified in Division 26 Section “Electrical Identification” with black-filled lettering on back side of wall plate, and durable wire markers or tags inside outlet boxes.

3.3 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding." Connect wiring device grounding terminal to outlet box with bonding jumper. Use of quick ground strap or screw is not acceptable.

B. Connect wiring according to Division 16 Section "Conductors and Cables." Connect wiring devices by wrapping conductor around screw terminal or by using back wiring and tightening the screw securely.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Inspect each wiring device for defects.
2. Operate each wall switch with circuit energized and verify proper operation.
3. After installing wiring devices and after electrical circuitry has been energized, test each receptacle for proper polarity, ground continuity, and compliance with requirements.
4. Test each GFCI receptacle for proper operation with both local and remote fault simulations according to manufacturer's written instructions.
B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 16140
SECTION 16145 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL.........................................................1
  1.1 RELATED DOCUMENTS..............................................1
  1.2 SUMMARY............................................................1
  1.3 REFERENCES.......................................................2
  1.4 DEFINITIONS.......................................................2
  1.5 SUBMITTALS.......................................................3
  1.6 QUALITY ASSURANCE.............................................3
  1.7 COORDINATION....................................................3
  1.8 DELIVERY, STORAGE, AND HANDLING.............................4

PART 2 - PRODUCTS......................................................4
  2.1 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS............4
  2.2 OCCUPANCY SENSORS.............................................4

PART 3 - EXECUTION.....................................................9
  3.1 OCCUPANCY SENSOR INSTALLATION...............................9
  3.2 WIRING INSTALLATION...........................................9
  3.3 IDENTIFICATION................................................10
  3.4 FIELD QUALITY CONTROL.......................................10
  3.5 ADJUSTING.......................................................11

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 the following lighting control devices:

  1. Occupancy sensors.

B. Related Sections include the following:

  1. Division 16 Section “Electrical General Requirements”.
  2. Division 16 Section "Wiring Devices" for wall-box dimmers and manual light switches.
  3. Division 16 Section "Dimming Controls" for architectural dimming system equipment.
1.3 REFERENCES


E. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.

F. UL 486B: Wire Connectors for Use with Aluminum Conductors.

G. UL 773: Plug-in, Locking Photocontrols for Use with Area Lighting.

H. UL 773A: Nonindustrial Photoelectric Switches for Lighting Control.

I. UL 917: Clock Operated Switches.

J. UL 1449: Transient Voltage Surge Suppressors.

K. UL 1598: Luminaires.

L. NECA 130-2010: Installing and Maintaining Wiring Devices.

1.4 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

C. ULTRASONIC: Active emission of at least 35 kHz sound waves, using Doppler reflectance to detect motion.

D. MICROPHONIC: Passive reception to listen for continued occupancy, with circuitry to filter out white noise.
E. MULTI-Tech: Using PIR and ultrasonic or microphonic technologies in one sensor.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated including physical data and electrical performance.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Lighting plan showing location, orientation, and coverage area of each sensor.
2. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. Include the following:

1. Description of operation and servicing procedures.
2. List of major components.
3. Recommended spare parts.
4. Programming instructions and system operation procedures.

1.6 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.

1.7 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. Coordinate interface of lighting control devices with temperature controls specified in Division 15.
1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site under provisions of Division 16Section “Electrical General Requirements”.

B. Store and protect products under provisions of Division 16Section “Electrical General Requirements”.

PART 2 - PRODUCTS

2.1 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

2.2 OCCUPANCY SENSORS

A. General

1. Coordinate occupancy sensor locations, coverages and required quantities with manufacturer’s recommendations. Coverage areas indicated on the Drawings are for minor motion (6 to 8 inches of hand movement). Provide additional occupancy sensors and control units as required to achieve complete minor motion coverage of the space indicated.

2. Adjust occupancy sensors and test that complete minor motion coverage is obtained in accordance with Part 3. Provide written confirmation of testing to owner, architect and engineer.

3. Provide occupancy sensors with a bypass switch to override the “ON” function in the event of sensor failure.

4. Provide occupancy sensors with an LED indicator indicating when motion is being detected during testing and normal operation of the sensor.

5. Provide occupancy sensors and occupancy sensor control units from single manufacturer.

B. Wall Switch Passive Infrared Occupancy Sensor

C. Manufacturers:
a. Perfect Sense – PS-PWS
b. Wattstopper PW-100.
d. Greengate OSW-P-0451-W.
e. Sensorswitch WSD.
f. Philips LRS2210.
g. Leviton ODS10-IDW.

2. Description: Wall mounted, 180° coverage, passive infrared sensing occupancy sensor.

a. Electrical Characteristics: Capable of switching up to 800W fluorescent or incandescent lighting loads at 120V and 1200 watts fluorescent loads at 277V.


c. Adjustments: User adjustable sensitivity and time delay. Time delay shall be adjustable from 30 seconds to 30 minutes.

d. Device Body: White plastic with momentary on/off override pushbutton designed to mount in a standard switch box with “decora” style switch plate.

3. Dual Level Switching: Provide occupancy sensor capable of controlling two switch legs independently where dual level switching is indicated.

a. Manufacturers:

1) Perfect Sense PWD.
2) Wattstopper PW-200.
4) Greengate OSW-P-0451-DMV.
5) Sensorswitch WSD-2P.
6) Philips LRS2215.
7) Leviton ODS10-IDW.

D. 360° Ceiling Mounted Dual Technology Occupancy Sensor

1. Manufacturers:

a. Perfect Sense CDS.
b. Wattstopper DT 300
d. Greengate OMC-DT-2000-R.
e. Sensorswitch CM-PDT-R.
f. Philips LRM2255.
g. Leviton OSC10-M0W.

2. Description: Ceiling mounted, 360° coverage, multi-tech sensing occupancy sensor.
   a. Housing: White, thermoplastic, tamper resistant ceiling mount.
   b. Functions: Automatic ON must sense motion from both ultrasonic and infrared sensing elements. Either technology shall maintain ON, with adjustable time delays.
   c. Adjustments: User adjustable sensitivity adjustment shall be provided for each sensing technology. Time delay shall be adjustable from 30 seconds to 30 minutes.
   d. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
   e. Manual override function.
   f. Coverage: 1000 square foot minimum coverage.

E. 110° Wall Mounted Dual Technology Occupancy Sensor

1. Manufacturers:
   a. Perfect Sense DTC.
   b. Wattstopper DT-200
   c. Hubbell Building Automation “LO-DT” Series.
   d. Sensorswitch WV-PDT-R/WV-BR.
   e. Philips LRM2265.
   f. Leviton OSW12-M0W.

2. Description: Wall mounted, 110° coverage, multi-tech occupancy sensor.
   a. Housing: White, thermoplastic, tamper resistant with swivel bracket for wall or ceiling mounting.
   b. Functions: Automatic ON must sense motion from both sensing elements. Either technology shall maintain ON, with adjustable time delays.
c. Adjustments: User adjustable sensitivity adjustment shall be provided for each sensing technology. Time delay shall be adjustable from 30 seconds to 15 minutes.
d. Sensor Orientation: Orient sensor in room such that sensor will not detect motion through open door which could cause false activation.
e. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.

F. 360° Ceiling Mounted Ultrasonic Occupancy Sensors

1. Manufacturers:
   a. Perfect Sense WDS.
   b. Wattstopper “WT” Series.
   e. Sensorswitch CM MPT-10.
   f. Philips LRM2255.
   g. Leviton OSC20-U0W.

2. Description: Ceiling mounted, 360° coverage, ultrasonic or microphonics sensing occupancy sensor.
   a. Housing: White, thermoplastic, tamper resistant.
   b. Adjustments: User adjustable sensitivity and time delay. Time delay shall be adjustable from 30 seconds to 15 minutes.
   c. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.


1. Manufacturers:
   a. Perfect Sense CPS.
   a. Wattstopper CI-200.
   b. Hubbell Building Automation OMNI-IR.
   c. Greengate OMC-P-04500-R.
e. Philips LRM2250.
f. Leviton OSC04-I0W.

2. Description: Ceiling mounted, 360° coverage, infrared sensing occupancy sensor.

a. Housing: White, thermoplastic, tamper resistant ceiling mount.
b. Adjustments: User adjustable sensitivity adjustment shall be provided for each sensing technology. Time delay shall be adjustable from 30 seconds to 30 minutes.
c. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
e. Coverage 1000 square foot minimum coverage for minor motion.

H. Occupancy Sensor Control Units:

1. Description: Transformer and relay combined in single unit to provide 24DC power to sensors and provide 20A contact(s) for control of lighting loads at 120 or 277V. Control unit input power shall be from unswitched leg of lighting circuit it is controlling.

a. Control units shall be provided as required to power ceiling mounted occupancy sensors and control lighting loads and to provide a minimum of one auxiliary contact.
b. Occupancy sensor control units shall mount external to 4” sq junction box in the ceiling space. Wiring between control unit and occupancy sensor shall be plenum rated.
c. Locate control unit in accessible location in gyp-board ceilings, adjacent to return air grilles, or provide access panel.
d. Additional auxiliary relay modules shall be provided as required to provide control of all lighting circuits and additional auxiliary contacts as required.
e. It is acceptable to provide controls and auxiliary contacts as required integral to the ceiling sensor, provided all required contacts are provided.

f. Maximum of 3 sensors per power pack. Verify exact quantities required with manufacturer.

PART 3 - EXECUTION

3.1 OCCUPANCY SENSOR INSTALLATION

A. Install wall mounted occupancy sensors as noted on plan. Arrange occupancy sensors with adjacent switch devices so that device plates line-up and are equally spaced.

B. Install ceiling mounted sensors at approximate locations as indicated on plan. Sensor manufacturer shall provide quantity of sensors as required to provide complete coverage for rooms.

C. Locate sensors such that motion through open doors will not falsely activate sensors.

D. Do not locate ultrasonic sensors within six feet of supply air diffusers.

E. Locate infrared sensors to avoid obstructions.

F. Provide the services of a manufacturer’s representative for commissioning of occupancy sensor installation. This shall include consultation on layout and location prior to installing sensors, testing of each sensor for compliance with Contract Documents and field adjustment and fine tuning after installation is complete. Provide written confirmation of testing to the Owner, Architect and Engineer.

G. Field adjustments shall take place in the presence of the owner and the engineer. This shall include owner training on adjustment techniques for the occupancy sensors.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Division 16Section "Conductors and Cables".
B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

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.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Division 16Section "Electrical Identification."

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify actuation of each sensor and adjust time delays.

B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION 16145
SECTION 16442 - PANELBOARDS

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 the following:

1. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. AFCI: Arc-fault circuit interrupter.

E. RFI: Radio-frequency interference.

F. RMS: Root mean square.

G. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, surge protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Related Submittals:

1. Provide overcurrent device coordination study to demonstrate proper overcurrent device ratings, adjustments, and settings.

C. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

   a. Enclosure types and details for types other than NEMA 250, Type 1.
   b. Bus configuration, current, and voltage ratings.
   c. Short-circuit current rating of panelboards and overcurrent protective devices.
   d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.

D. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand
seismic forces defined in Division 16 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

G. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.
1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.
C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

   a. Eaton Corporation; Cutler-Hammer Products.
2.2 MANUFACTURED UNITS

A. Enclosures: Mounting as noted on panel schedules. NEMA PB 1, Type 1.
   1. Cabinet Front: Flush or surface cabinet as noted on the Drawings.
      a. Eaton LTDD (Piano hinge trim)
   2. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

B. Phase and Ground Buses:
   2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

C. Conductor Connectors: Suitable for use with conductor material.
   1. Main and Neutral Lugs: Mechanical type.
   2. Ground Lugs and Bus Configured Terminators: Compression type.
   3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   4. Double Lugs: Mechanical type mounted at location of main incoming lugs.

D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.
2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Main bus bars, neutral and ground, shall be sized in accordance with U.L. Standards to limit temperature rise on any current carrying part to the maximums as indicated in UL67.

B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: NEMA AB 3, with interrupting capacity to meet available fault currents.


   a. Circuit Breakers 250A and Larger: Magnetic trip element with front-mounted, field-adjustable trip setting with restricted access cover.

2. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings with restricted access cover:

   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and $I^2t$ response.

3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).

5. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).

6. AFCI Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
4. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
5. Shunt Trip: 120-V trip coil energized from separate circuit.
6. Do not use tandem circuit breakers.
7. Provide lock on devices for circuit breakers when called out on panel schedules with “OD” designation.
8. Provide type GFEP circuit breakers for all self-regulating heating (snow melting and heat trace) cables branch circuits and where noted on panel schedules with “GFEP” designation
9. Provide GFCI circuit breaker when called out on panel schedules with “GFCI” designation.
11. Provide shunt trip breakers when called out on panel schedules with “STB” designation.
12. Provide smart controllable circuit breakers when called out on panel schedules with “SMT” designation.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

D. Fuses are specified in Division 16 Section "Fuses."

E. Circuit Breaker Selection for Transformer Primary Protection:
1. Circuit Breaker Selection for Transformer Primary Protection: Provide circuit breakers with time-current characteristics to clear transformer inrush currents while still providing protection for the ANSI through-fault protection curve. Provide circuit breakers with adjustable magnetic trip or electronic trip units as necessary to provide time-current curve shaping to achieve long time trip indicated on drawings, inrush coordination and damage protection.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Division 16 Section “Hangers and Supports for Electrical Systems.”

C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.

D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

E. Install overcurrent protective devices and controllers.

1. Set field-adjustable switches and circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch empty conduits from recessed panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads or created by retrofitting. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Coordinate final directory room names and numbers with Owner.

C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Testing: Perform the following field quality control tests in accordance with Division 16 section “Electrical Testing”

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters. Perform electrical tests on all breakers and switches.
200A and above or that constitute a component of an emergency distribution system. Main circuit breakers in branch circuit panelboards 225A and below are not required to be tested.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16442
SECTION 16461 - DRY-TYPE TRANSFORMERS (600 V AND LESS)

PART 1 - GENERAL................................. .............1
1.1 RELATED DOCUMENTS................................. .............1
1.2 SUMMARY............................................ .......1
1.3 REFERENCES......................................... .......2
1.4 SUBMITTALS......................................... .......2
1.5 QUALITY ASSURANCE.................................. .......4
1.6 DELIVERY, STORAGE, AND HANDLING.................... .......4
1.7 COORDINATION....................................... .......5

PART 2 - PRODUCTS.................................. .............5
2.1 MANUFACTURERS...................................... .......5
2.2 MATERIALS.......................................... .......5
2.3 DISTRIBUTION TRANSFORMERS.......................... .......6
2.4 CONTROL AND SIGNAL TRANSFORMERS.................... .......7
2.5 SOURCE QUALITY CONTROL.................................. .......7

PART 3 - EXECUTION................................. .............8
3.1 EXAMINATION........................................ .......8
3.2 INSTALLATION....................................... .......8
3.3 CONNECTIONS........................................ .......9
3.4 FIELD QUALITY CONTROL.................................. .......9
3.5 ADJUSTING.......................................... ......10

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 the following types of dry-type transformers rated 600 V and less, with capacities up to 750 kVA:

1. Distribution transformers.
2. Buck-boost transformers.
3. Isolation transformers.
4. Control and signal transformers.

B. Related Section includes the following:
1. Division 16 Section “Electrical General Requirements.”
2. Division 16 Section “Grounding and Bonding.”
3. Division 16 Section “Conductors and Cables.”
4. Division 16 Section “Raceways and Boxes.”

1.3 REFERENCES

A. ANSI/IEEE C57.12.9: Test Code for Dry-Type Distribution and Power Transformers
B. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum)
C. NEMA ST 1: Specialty Transformers
D. NEMA ST 20: Dry Type Transformers for General Applications
E. NEMA TP 1: Guide for Determining Energy Efficiency for Distribution Transformers
H. NFPA 70: National Electrical Code
I. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors
J. UL 486B: Wire Connectors for Use with Aluminum Conductors
K. UL 506: Specialty Transformers
L. UL 1561: Dry-Type General Purpose and Power Transformers

1.4 SUBMITTALS

A. Product Data Include rated nameplate data, capacities, weights, dimensions, utility or manufacturer’s anchorage and base recommendations, minimum clearances, installed
devices and features, and performance for each type and size of transformer indicated.

1. Transformer Inrush: Provide time-current coordination curves demonstrating transformer inrush and ANSI damage curves with primary overcurrent device selections to clear inrush yet still protecting damage curve.

B. Shop Drawings: Wiring and connection diagrams.

C. Manufacturer Seismic Qualification Certification: Submit certification that transformer assembly and components will withstand seismic forces defined in Division 16 Section "Vibration and Seismic Controls for Electrical Work." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: Testing agency.

E. Source quality-control test reports. Include loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

F. Output Settings Reports: Record of tap adjustments specified in Part 3.
1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined in OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Transformer Inrush: Provide time-current coordination curves demonstrating transformer inrush and ANSI damage curves with primary overcurrent device selections to clear inrush yet still protecting damage curve.

2. Testing Agency’s Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise onsite testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with IEEE C 57.12.91.

D. Comply with NFPA 70.

E. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.
B. Store, protect, and handle products to site under provisions of Division 16 section “Electrical General Requirements.”

C. Deliver transformers individually wrapped for protection and mounted on shipping skids.

D. Accept transformers on site. Inspect for damage.

E. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

F. Handle in accordance with manufacturer’s written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork shall meet load requirements. Requirements for concrete bases for electrical equipment are specified in Division 16 “Hangers and Supports for Electrical Systems.”

B. Coordinate installation of wall-mounting and structure-hanging supports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:


2.2 MATERIALS

A. Cores: Grain-oriented, non-aging silicon steel.

B. Coils: Continuous windings without splices, except for taps.
1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Copper

C. Vibration Isolation: Isolate core and coil from enclosure using vibration-absorbing mounts.

D. Grounding: Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

2.3 DISTRIBUTION TRANSFORMERS

A. Description: Factory-assembled and tested, air cooled, dry-type transformer rated for 60 Hz operation. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers with base KVA as indicated without the use of internal cooling fans.

C. Provide transformers that are internally braced to withstand seismic forces specified in Division 16 Section "Seismic Controls for Electrical Work."

D. Cores: One leg per phase.

E. Indoor Enclosure: Ventilated, NEMA 250, Type 2. Provide lifting eyes or brackets.

F. Indoor Transformer Enclosure Finish: Comply with NEMA 250 for "Indoor Corrosion Protection."
   1. Finish Color: Gray.

G. Outdoor Enclosure: Ventilated, raintight, NEMA 250, Type 3R. Provide lifting eyes or brackets.

H. Outdoor Transformer Enclosure Finish: Comply with NEMA 250 for “Outdoor Corrosion Protection.”
   1. Finish Color: Gray.

I. Insulation Class (15 kVA and larger): 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature TP-1 compliant.
J. Insulation Class (less than 15 kVA): 185 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

K. Basic Impulse Level: 10 kV.

L. Taps for Transformers Smaller Than 3 kVA: None.

M. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

N. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

O. Case Temperature: Do not exceed 35 degrees C rise above ambient at warmest point.

P. Mounting: Suitable for mounting as indicated.

Q. Wall Brackets: Manufacturer's standard brackets.

R. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.4 CONTROL AND SIGNAL TRANSFORMERS

A. Description: Factory-assembled and tested, self-cooled, two-winding dry type, rated for continuous duty, and 60 Hz operation, complying with NEMA ST 1, and listed and labeled as complying with UL 506.

B. Ratings: Continuous duty. If rating is not indicated, provide at least 50 percent spare capacity above connected peak load.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. Provide the following factory tests on each unit provided in accordance with NEMA ST 20:

1. Voltage ratio.
2. Polarity and phase relation.
3. No load losses.
4. Impedance (501 kVA and larger).
5. Applied and induced potential.

C. Provide the factory tests on the actual transformers provided or on similar units identical to those provided in accordance with NEMA ST 20:
   1. Impedance (less than 501 kVA).
   2. Temperature rise.
   3. Audible sound level.
   4. Full load losses.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls and floors for suitable mounting conditions where transformers will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install Products in accordance with manufacturer’s instructions.

B. Install floor mounted transformers on and anchor to concrete bases according to manufacturer’s recommendations.

   1. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.

C. Identification: Engraved metal or laminated-plastic nameplate mounted with corrosion resistant screws. Provide nameplate according to Division 16 Section “Electrical Identification” indicating the following:
1. Transformer designation (e.g. “T-1”).
2. Primary power characteristics (e.g. “480V, 3PH, 3W”).
3. Secondary power characteristics (e.g. “208Y/120V, 3PH, 4W”).
4. Power rating (e.g. “75 kVA”).
5. Power source (e.g. “Fed from DP-1”).

3.3 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

C. Provide conduit according to Division 16 Section “Raceways and Boxes” for connections to transformer case. Make conduit connections to side panel of enclosure.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Check for damage and tighten connections prior to energizing transformer.

3.4 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.

1. Verify that electrical wiring installation complies with manufacturer’s written installation requirements.
   a. Inspect for physical damage, cracked insulators, tightness of connections, defective wiring and general mechanical and electrical conditions.
   b. Verify proper core grounding.
   c. Verify proper equipment grounding.
   d. Compare equipment nameplate with single line diagram and report discrepancies.

2. Electrical Tests
a. Perform insulation resistance tests, winding-to-winding and windings-to-ground, utilizing a meg-ohmmeter with test voltage output in accordance with N.E.T.A. Acceptance Testing Specifications, Table 10.5. Test duration shall be for 10 minutes with resistance values tabulated at 30 seconds, 1 minute, and 10 minutes. Calculate Polarization Index.

b. Perform a turn ratio test between windings at every tap position. The final tap setting is to be set at the secondary system rated voltage at full load or as directed by the Architect/Engineer.

c. Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

3. Test Values

a. Perform insulation resistance tests in accordance with N.E.T.A. Acceptance Testing Specifications, Table 10.5. Results to be temperature corrected in accordance with Table 10.14.

b. The polarization index should be above 1.2 unless an extremely high value is obtained initially, such that when doubled will not yield a meaningful value.

c. Turns ratio test results shall not deviate more than one half percent (0.5%) from either the adjacent coils or the calculated ratio.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent. Submit recording and tap settings as test results.

B. Adjust buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

END OF SECTION 16461
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 the following:

1. Interior lighting fixtures with lamps and ballasts.
2. Exit signs.
3. Accessories, including occupancy sensors.
B. Related Sections include the following:

1. Division 16 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.
2. Division 16 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
3. Division 16 Section "Dimming Controls" for architectural dimming systems.

1.3 Definitions

A. BF: Ballast factor. Ratio of light output of a given lamp(s) operated by the subject ballast to the light output of the same lamp(s) when operated on an ANSI reference circuit.

B. CRI: Color rendering index.

C. CU: Coefficient of utilization.

D. LER: Luminaire efficiency rating, which is calculated according to NEMA LE 5. This value can be estimated from photometric data using the following formula:

1. $LER = \frac{\text{total rated lamp lumens} \times BF \times \text{luminaire efficiency}}{\text{input watts}}$

E. RCR: Room cavity ratio.

1.4 Submittals

A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Submit as one package, bound together. Include data on features, accessories, finishes, and the following:

1. Physical description of fixture, including dimensions and verification of indicated parameters.
2. Fluorescent ballasts.
3. Lamps.
4. Photometric performance data.
B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

C. Wiring Diagrams: Power, signal, and control wiring.

D. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which lighting-fixture suspension systems will be attached.
3. Other items in finished ceiling, including the following:
   a. Air outlets and inlets.
   b. Speakers.
   c. Sprinklers.
   d. Access panels.
4. Perimeter moldings.

E. Product Certificates: For each type of ballast for dimmer-controlled fixtures, signed by product manufacturer.

F. Source quality-control test reports.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures" include the following:

1. Catalog data for each fixture. Include the diffuser, ballast, and lamps installed in that fixture.

I. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a
testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with:

1. NFPA 70 - National Electrical Code.
8. Michigan Department of Community Industry Services requirements that all lamps shall be protected from breakage. Exposed lamps are not acceptable.

C. FMG Compliance: Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

E. Mockups: Provide lighting fixtures for room or module mockups. Install fixtures for mockups with power and control connections.

1. Obtain Architect's approval of fixtures for mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Special Warranty for Fluorescent Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.

B. Manufacturer's Special Warranty for T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: One year from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

3. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
PART 2 - PRODUCTS

2.1 FIXTURES AND COMPONENTS, GENERAL

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1572. Where LER is specified, test according to NEMA LE 5B.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

G. 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.

H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

I. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   a. Lens Thickness: At least 0.125 inch minimum unless different thickness is scheduled.
   b. UV stabilized.
2. Glass: Annealed crystal glass, unless otherwise indicated.

J. General:

1. Install ballasts, and specified accessories at factory.
2. Install lamps on project site after fixture installation.
3. Provide factory installed ballast disconnecting means required by NFPA 70.

2.2 LIGHTING FIXTURES

A. Provide lighting fixtures as included in specification 16511A “Lighting Fixture Product Data.” This section contains product data sheets from the basis of design manufacturer with annotations.

B. Acceptable alternate manufacturers are indicated on the product data sheets. Alternate manufacturer products shall be equal in all respects including materials, finishes, photometric performance and energy performance and shall include all options, features, and accessories identified.

C. The lighting fixture schedule shown on the drawings is supplemental provided for convenience and reference only. The requirements of this section and 16511A shall govern.

2.3 FLUORESCENT LAMP BALLASTS

A. Description: Include the following features, unless otherwise indicated:

1. Designed for type and quantity of lamps indicated at full light output except for emergency lamps powered by in-fixture battery-packs.
2. Externally fused with slow-blow type rated between 2.65 and 3.0 times the line current.

B. Program rapid start electronic ballasts for linear lamps shall include the following features, unless otherwise indicated:

1. Products:
   a. Advance/Phillips.
b. Sylvania/Motorola.
c. ACE (for low temperature ballast).

2. Comply with NEMA C82.11.
3. Ballast Type: Programmed rapid start, unless otherwise indicated.
4. Programmed Start: Ballasts with two-step lamp starting to extend life of frequently started lamps.
5. Sound Rating: A.
6. Total harmonic distortion rating of less than 20 percent according to NEMA C82.11. Input current third harmonic content shall not exceed 10%.
7. Transient Voltage Protection: IEEE C62.41, Category A.
8. Operating Frequency: 25 kHz or higher, and operate without visible flicker.
10. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.
11. Power factor shall be 90% minimum.
12. Ballast factor shall be .85 to 1.00.

C. Ballasts for compact lamps shall have the following features, unless otherwise indicated:

1. Products:
   a. Advance/Phillips.
   b. Sylvania/Motorola.

2. Type: Electronic.
3. Power Factor: 90 percent, minimum.
4. Flicker: Less than 5 percent.
5. Lamp Current Crest Factor: Less than 1.7.
6. Electronic Ballast Operating Frequency: 25 kHz or higher.
7. Lamp end-of-life detection and shutdown circuit.
8. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
9. THD shall be 20% or less. Input current third harmonic content shall not exceed 20%.
10. Ballast shall be UL listed, Class P with a sound rating at or below Class A.
11. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and
2.4 EXIT SIGNS

A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps: Light-emitting diodes, 70,000 hours minimum of rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

D. Provide edge lit signs with a mirror plaque background.

2.5 FLUORESCENT EMERGENCY LIGHTING FIXTURES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Internal Type:
   b. Iota.
   c. Dual Lite.
   d. Lithonia.

2. Description: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.

3. Emergency Connection: Operate one or two fluorescent lamps continuously. Connect unswitched circuit to...
battery-inverter unit and switched circuit to fixture ballast.
   a. For any area where only one luminare is provided for emergency operation, two lamps shall operate under loss of normal power.

4. Night Light Connection: Operate one or two fluorescent lamps continuously.
   a. For any area where a night light also operates as an emergency light and only one luminare is provided for night light/emergency operation, two lamps shall operate under loss of normal power.

5. Test Switch and Light-Emitting-Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space. [Install remote test switch and plate in adjacent ceiling tile.]


8. Lamp Ratings:

<table>
<thead>
<tr>
<th>Lamp Type</th>
<th>Minimum Lumen Output (one or two lamps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F25T8</td>
<td>1250/1100</td>
</tr>
<tr>
<td>F32T8</td>
<td>1350*</td>
</tr>
<tr>
<td>F28T5</td>
<td>1245*</td>
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<tr>
<td>F54T5HO</td>
<td>1200</td>
</tr>
<tr>
<td>PLT70W</td>
<td>1200</td>
</tr>
<tr>
<td>PLT57W</td>
<td>1150</td>
</tr>
<tr>
<td>PL-T 42W</td>
<td>1000</td>
</tr>
<tr>
<td>PL-T 32W</td>
<td>700/1000</td>
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<tr>
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<td>575/875</td>
</tr>
<tr>
<td>PL-T 18W</td>
<td>375/625</td>
</tr>
<tr>
<td>F13TBX/PL-C 13W</td>
<td>350/425</td>
</tr>
<tr>
<td>PL-C 26W</td>
<td>450/700</td>
</tr>
<tr>
<td>PL-C 18W</td>
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<td>900*</td>
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<tr>
<td>F40 BX</td>
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<tr>
<td>F39/36 BX</td>
<td>1100*</td>
</tr>
<tr>
<td>F27/24 BX</td>
<td>1100*</td>
</tr>
<tr>
<td>F18 BX</td>
<td>500*</td>
</tr>
</tbody>
</table>

* Indicates ratings for minimum output for one and two lamps.
9. Universal transformer to operate at 120 volt or 277 volt.

2.6 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches 1219 mm, 2800 initial lumens (minimum), CRI greater than 80, color temperature of 4000, and average rated life of 20,000 hours, unless otherwise indicated.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Fluorescent Lamp Manufacturers:
   1. Osram Sylvania.
   2. General Electric.
   3. Philips.

2.7 FIXTURE SUPPORT COMPONENTS

A. Comply with Division 16 Section "Electrical Supports" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.


E. Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage

F. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
H. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.8 FINISHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Fixtures: Manufacturers' standard, unless otherwise indicated.

1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.

2.9 SOURCE QUALITY CONTROL

A. Provide services of a qualified, independent testing and inspecting agency to factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.

B. Factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.

PART 3 - EXECUTION

3.1 INSTALLATION


B. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

C. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

D. NFPA 70 requires minimum support for fixtures. Retain first paragraph and subparagraphs below for more specific support requirements and for requirements exceeding code minimums. Units in seismic areas must have additional supports and restraining devices beyond those specified here. See Editing Instruction No. 3 in the Evaluations.
E. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.

2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.

3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

F. Support luminaires independent of ceiling framing. Support recessed grid luminaries from two opposite corners directly to structure. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

G. Install recessed luminaires to permit removal from below.

H. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Suspended Fixture Support: As follows:

1. Install suspended luminaires and exit signs using pendants supported from swivel hangers except where noted to use chain hangers. Provide pendant length required to suspend luminaire at indicated height.


4. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

5. Continuous Rows: Suspend from cable.

J. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
K. Emergency lighting units and fluorescent emergency lighting fixtures with unit battery inverters shall be circuited to unswitched hot leg of adjacent circuit and shall activate on loss of primary power.

3.2 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

C. Bond products and metal accessories to branch circuit equipment grounding conductor.

D. Connect luminaires to branch circuit outlet boxes provided under Division 16 Section "Raceways and Boxes" using 1/2" flexible conduit.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Examine each luminaire to determine suitability for lamps specified.

C. Verify normal operation of each fixture after installation.

D. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

F. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.
G. Check for variance in lamp color temperature throughout project.

H. Spot check for lamp output level from start up through 10 minute duration and make rotation.

I. All fluorescent and H.I.D. lamps shall be allowed to run a minimum of 100 hours, continuously, prior to punchlist or any dimming.

3.4 ADJUSTING

A. Aim and adjust luminaires as directed by the Architect/Engineer.

B. Adjust exit sign directional arrows as indicated on Drawings.

C. Relamp luminaires that have failed lamps at Substantial Completion.

D. Adjust all “low end trim” settings of dimming switches prior to punchlist.

E. Adjust and calibrate all dimming system controls until the system works as designed. Contact the Architect/Engineer when dimming is complete and demonstrate operation to owner’s representative and Architect/Engineer.

3.5 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosures and lenses.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

END OF SECTION 16511
SECTION 16570 - DIMMING 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 the following:

2. Integrated, multi-pre-set, modular dimming controls.
3. Multichannel, remote-controlled dimmers.

B. Related Sections include the following:
1. Division 16 Section “Electrical General Requirements”.  
2. Division 16 Section "Wiring Devices" for wall-box dimmers and manual light switches.  
3. Division 16 Section "Conductors and Cables".  
4. Division 16 Section "Raceways and Boxes".  
5. Division 16 Section "Lighting Control Devices" for time switches, photoelectric switches, occupancy sensors, and multipole contactors.  
6. Division 16 Section "Interior Lighting" for ballasts and lamps for interior luminaires.

1.3 DEFINITIONS

A. Channel: A fixture or group of fixtures controlled simultaneously as a single entity. Also known as a "zone."

B. Fade:
   1. Fade Override: The ability to temporarily set fade times to zero for all lighting scenes.
   2. Fade Rate: The time it takes each channel to arrive at the next scene, depending on the degree of change in lighting level.
   3. Fade Time: The time it takes a channel to fade from one lighting scene to another.

C. LED: Light-emitting diode.

D. NRTL: Nationally recognized testing laboratory.

E. Scene: The lighting effect created by adjusting several channels of lighting to the desired intensity.

F. Wall-Box Dimmer: A self-contained dimmer that fits into a switch box.

1.4 REFERENCES


C. NFPA 70: National Electrical Code

D. UL 486 A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.

E. UL 486B: Wire Connectors for Use with Aluminum Conductors.

F. UL 508: Industrial Control Equipment.

G. UL 1008: Transfer Switch Equipment.

H. UL 1449: Transient Voltage Surge Suppressors.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. For dimming controls, include dimensions, features, characteristics, and ratings.
   2. Device plates and plate color and material.
   3. Ballasts and lamp combinations compatible with dimmer controls.
   4. Sound data including results of operational tests of dimming controls.
   5. Operational documentation for software and firmware.

B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on Project. Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
   1. Include elevation views of front panels of control and indicating devices and control stations.
   2. Wiring Diagrams: Power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes and technical features for flush-mounting, dimming control station faceplates.

D. Samples for Verification: Manufacturer's standard sizes for flush-mounting, dimming control station faceplates.

E. Operation and Maintenance Data: For dimming controls with remote-mounting dimmers to include in emergency, operation, and maintenance manuals. In addition to items
specified in Division 1 Section "Closeout Procedures" include the following:

1. Software manuals.
2. Adjustments of scene preset controls, adjustable fade rates, and fade overrides.
3. Operation of adjustable zone controls.
4. Testing and adjusting of panic and emergency power features.

F. As-Built Drawings: Provide accurate “as built” drawings to the owner indicating the correct and latest program in each controller. The “as-built drawings” shall clearly indicate the dimming control panel identification, the load controlled by each relay, and the device connected to each input.

G. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain dimming controls from a single source with total responsibility for compatibility of lighting control system components specified in this Section, in Division 16 Section "Lighting Control Devices."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.

D. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate features of devices specified in this Section with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions. Include coordination with the following:
1. Division 16 Section "Lighting Control Devices."

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of dimming controls that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Damage from transient voltage surges.

2. Warranty Period: Cost to repair or replace any parts for two years from date of Substantial Completion.

3. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years, that failed in service due to transient voltage surges.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of amount installed for each size installed, but no fewer than three.

PART 2 - PRODUCTS

2.1 GENERAL DIMMING DEVICE REQUIREMENTS

A. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state dimmers and control panels.

1. Alternative Line-Voltage Surge Suppression: Field-mounting surge suppressors that complies with UL 1449 and with IEEE C62.41, for Category A locations.

B. Compatibility: Dimming control components shall be compatible with other elements of lighting fixture types, ballasts, transformers, and lighting controls.
C. Dimmers and Dimmer Modules: Comply with UL 508.

1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.

2. Provide a positive air gap relay with each dimmer to ensure that the load circuits are open when the “off” function is selected at a control station.

3. Dimmer or Dimmer-Module Rating: As indicated, but not less than 125 percent of connected load.

D. Panic Switch: Include where indicated or required by authorities having jurisdiction. Switch operation overrides dimmer settings and restores lights on connected output circuits to full brightness regardless of settings.

2.2 MANUAL SWITCHES AND PLATES

A. Switches: Modular, momentary push-button, low-voltage type.

1. Color: White, unless otherwise indicated.

2. Integral Pilot Light: Indicate when circuit is on. Use where indicated.

3. Locator Light: Internal illumination.

4. Wall Plates: Match those specified in Division 16 Section "Wiring Devices" for materials, finish, and color. Use multigang plates if more than one switch is indicated at a location.

5. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.3 CONDUCTORS AND CABLES

A. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying Division 16 Section "Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 18 AWG,
complying with Division 16 Section "Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Division 16 Section "Conductors and Cables."

D. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Division 16 Section "Conductors and Cables."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Wiring Method: Comply with Division 16 Sections "Conductors and Cables" and "Raceways and Boxes".

B. 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.

C. Install field-mounting, transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

F. 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.

3.2 IDENTIFICATION

A. Identify components and power and control wiring according to Division 16 Section "Electrical Identification."

B. Label each dimmer module with a unique designation.
3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Continuity tests of circuits.
2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
   a. Include testing of dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

B. Remove and replace malfunctioning dimming control components and retest as specified above.

C. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.

D. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.4 MANUFACTURER SUPPORT

A. Manufacturer telephone support shall be available at no cost to the Owner during the warranty period and shall include the following:

1. Assistance in solving programming or other application issues pertaining to the control equipment.
2. The manufacturer shall provide a toll-free number for technical support.

END OF SECTION 16570
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Related Sections include the following:

1. Division 16 Section “Electrical General Requirements.”

1.2 SUMMARY

A. This Section includes design and installation of new devices onto an existing fire alarm system.

B. Related Sections include the following:

1. Division 8 Section "Door Hardware" for door closers and holders with associated smoke detectors, electric door locks, and release devices that interface with the fire alarm system.

1.3 DEFINITIONS

A. FACP: Fire alarm control panel.

B. LED: Light-emitting diode.

C. NICET: National Institute for Certification in Engineering Technologies.

D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.4 SYSTEM DESCRIPTION

A. Noncoded, addressable system; multiplexed signal transmission dedicated to fire alarm service only.

1. Interface with existing fire alarm system.

B. Noncoded, analog-addressable system; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.

1. Interface with existing fire alarm system.

C. Fire alarm system shall consist of the following:

1. New fire alarm devices as indicated on drawings and wiring.
2. System smoke detection as required at air handling units, smoke rated transfer openings, and smoke damper locations.

3. Manual fire alarm boxes at each building exit (prior to entering exit stairwells at each floor).

4. Audible and visual notification appliances in areas of the building indicated on drawings.

1.5 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 72.

B. A complete functional system meeting the requirements of this specification, including alarm initiating devices and notification appliances at locations and ratings to meet the requirements of the Authorities Having Jurisdiction and all applicable codes shall be provided.

C. Coordinate and avoid conflicts with casework, marker boards, feature walls, and other areas where fire alarm devices would interfere with furnishings, finishes, etc.

D. Fire alarm system vendor shall provide sound pressure level calculations demonstrating compliance with NFPA 72 and establish quantities and tap settings of audible devices.

E. No additional charges for work or equipment required for a code compliant system approved by the Authority Having Jurisdiction will be allowed.

F. System functional performance shall be as indicated on the fire alarm matrix on the drawings.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Shop Drawings shall be prepared by persons with the following qualifications:

   a. Trained and certified by manufacturer in fire alarm system design.

   b. Fire alarm certified by NICET, minimum Level III.
2. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.

3. Device Address List: Include address descriptions that will appear on the FACP display.

4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.

5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.

6. Batteries: Provide battery sizing calculations. Battery size shall be a minimum of 125% of the calculated requirement.

7. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.

8. Ductwork Coordination Drawings: Plans, sections, and elevations of ducts, drawn to scale and coordinating the installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, the detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.

9. Voice/Alarm Signaling Service: Equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.

10. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show device layout, size and route of cable and conduits.

C. Qualification Data: For Installer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for
Owner's manual. Include abbreviated operating instructions for mounting at the FACP.

F. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

G. Documentation:

1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect, and Authorities Having Jurisdiction.
2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.
   a. Hard copies on paper to Owner, Architect, and Authorities Having Jurisdiction.
   b. Electronic media may be provided to Architect.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Work of this Section be performed by a UL-listed company.

C. Installer Qualifications: Personnel certified by NICET as Fire Alarm Level II.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
1.8 PROJECT CONDITIONS

A. Interruption of Existing Fire Alarm Service: Do not interrupt fire alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Architect, Construction Manager and Owner no fewer than seven days in advance of proposed interruption of fire alarm service.
2. Do not proceed with interruption of fire alarm service without Architect, Construction Manager and Owner written permission.

1.9 SEQUENCING AND SCHEDULING

A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of the new fire alarm system, remove existing disconnected fire alarm equipment.

1.10 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. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.
2. Smoke, Fire, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.
3. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.
4. Keys and Tools: One extra set for access to locked and tamper-proofed components.
5. Audible and Visual Notification Appliances: One of each type installed.
6. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. FACP and Equipment:

2.2 EXISTING FIRE ALARM SYSTEM

A. Compatibility with Existing Equipment: Fire alarm system and components shall operate as an extension of an existing system.

2.3 MANUAL FIRE ALARM BOXES

A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
2. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP. Double action pull stations shall meet ADA guidelines.
3. Station Reset: Key- or wrench-operated switch.
4. Indoor Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
2.4 SYSTEM SMOKE DETECTORS

A. General Description:

1. UL 268 listed, operating at 24-V dc, nominal.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
3. Multipurpose type, containing the following:
   a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
   b. Piezoelectric sounder rated at 88 dBA at 10 feet according to UL 464.
   c. Heat sensor, combination rate-of-rise and fixed temperature.
4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
   a. Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg F per minute.
   b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F.
   c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:
1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

C. Ionization Smoke Detector:

1. Sensor: Responsive to both visible and invisible products of combustion. Self-compensating for changes in environmental conditions.
2. Detector Sensitivity: Between 0.5 and 1.7 percent/foot smoke obscuration when tested according to UL 268A.

2.5 NOTIFICATION APPLIANCES

A. Description: Equipped for mounting as indicated and with screw terminals for system connections.


1. Finishes:
   a. Wall mounted appliances: Provide [red finish with white lettering] [white finish with red lettering].
   b. Ceiling Mounted Appliances: Provide white finish.

B. Bells: Electric-vibrating, 24-V dc, under-dome type; with provision for housing the operating mechanism behind the bell. Bells shall produce a sound-pressure level of 94 dBA, measured 10 feet from the bell. 10-inch size, unless otherwise indicated. Provide weatherproof bells where shown on building exterior and in other wet and damp locations.

C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn.
F. Voice/Tone Speakers:
   1. UL 1480 listed.
   2. High-Range Units: Rated 2 to 15 W.
   3. Low-Range Units: Rated 1 to 2 W.
   4. Matching Transformers: Tap range matched to the acoustical environment of the speaker location.

G. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.
   1. Rated Light Output: 15, 30, 60, 75, 110, 135, 185 candela as required to meet NFPA 72 requirements.
   2. Strobe Leads: Factory connected to screw terminals.

2.6 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate.
   1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
   2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.
   3. Rating: 24-V ac or dc.
   4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.7 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

2.8 ADDRESSABLE CONTROL MODULE

A. Provide for integration of auxiliary control functions into the analog signaling circuit. Intelligent analog signaling circuit control module shall have the following capabilities:
1. Communication interaction with the analog signaling circuit having the capability of initiating a control function to an auxiliary device based on a specified event.

2. Provide NO/NC contact pairs rated at 2 amps 120 VAC or 24 VDC.

2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Listed and labeled according to UL 632.

B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

D. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.10 GUARDS FOR PHYSICAL PROTECTION

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

   1. Factory fabricated and furnished by manufacturer of the device.
   2. Finish: Paint of color to match the protected device.
2.11 WIRE AND CABLE

A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.

B. Fire alarm wire and cable shall be as specified by the system manufacturer including conductor gage, conductor quantity, conductor twists and shielding required to meet NFPA class and style performance specified.

C. Signaling Line Circuits and other power limited fire alarm circuits (PLFA):

1. PLFA circuits installed in conduit or raceway: U.L. Listed type FPL
2. PLFA circuit cable installed exposed in accessible ceiling spaces, risers and elsewhere: U.L. Listed type FPLP.
3. PLFA circuits installed where 2 hr rating is required to meet the survivability requirements of NFPA 72: Circuit integrity cable, NFPA 70 Article 760, Classification CI, UL listed as Type FPL, FPLR or FPLP as required, and complying with requirements in UL 1424 and in UL 2196 for a 2-hour rating.

D. Non-Power-Limited Fire Alarm Circuits (NPLFA):

1. NPLFA circuits installed in conduit: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
   a. Low-Voltage Circuits: No. 16 AWG, minimum.
   b. Line-Voltage Circuits: No. 12 AWG, minimum.

2. NPLFA circuit cable installed exposed in ceiling spaces, risers and elsewhere: Multi-conductor cable, U.L Listed type NPLFP.
3. NPLFA circuits installed where 2 hr rating is required to meet the survivability requirements of NFPA 72: Multi-conductor cable, U.L Listed type NPLFP-CI
4. NPLFA circuit cable installed exposed in ceiling spaces, shafts and elsewhere: Multi-conductor Armored Cable, NFPA 70 Type MC, copper conductors, copper drain wire, aluminum or steel armor with red identifier stripe, UL listed for fire alarm and cable
FERNDALE PUBLIC SCHOOLS
2017 SINKING FUND PROJECTS
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tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Connecting to Existing Equipment: Verify that existing fire alarm system is operational before making changes or connections.

1. Connect new equipment to the existing control panel in the existing part of the building.
2. Connect new equipment to the existing monitoring equipment at the Supervising Station.
3. Expand, modify, and supplement the existing [control] [monitoring] equipment as necessary to extend the existing [control] [monitoring] functions to the new points.
4. New components shall be capable of merging with the existing configuration without degrading the performance of either system.

B. Smoke or Heat Detector Spacing:

1. Smooth ceiling spacing shall not exceed 30 feet
2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

C. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.

D. Duct Smoke Detectors: Comply with NFPA 72. Install sampling tubes so they extend the full width of the duct.

E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

F. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
G. Audible Alarm Notification Appliances: Install wall mounted appliances not less than 6 inches below the ceiling.

H. Visible Alarm Notification Appliances: Install wall mounted appliances at 96” AFF or 6 inches below the ceiling, whichever is less.

I. Coordinate ceiling mounted appliances with reflected ceiling plans. Do not install visual appliances where pendant mounted or suspended lighting fixtures will obstruct intended viewing angles.

J. Install wall mounted and ceiling mounted notification appliances flush on recessed j-box or back box for all new work and on existing gyp-board partition walls.

K. Install notification appliances on existing CMU walls on surface back-boxes matching the dimensions and finish of the notification appliance.

L. Device Location-Indicating Lights: Locate in public space near the device they monitor.

M. Provide all 120V branch circuits for all control panels, sub panels, and ancillary equipment required for the system.

3.2 WIRING INSTALLATION

A. Install wiring according to the following:

1. NECA 1.
2. TIA/EIA 568-A.

B. Wiring Method: Install wiring in metal raceway according to Division 16 Section "Raceways and Boxes."

1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

A. Wiring Method:
1. Fire alarm circuits shall consist of multi-conductor cables installed in accessible ceiling spaces.
2. Where ceilings consist of exposed construction, fire alarm multi-conductor cable shall be installed on top of joists, beams etc. and shall be concealed from view. Where the structural elements do not allow for the cable to be installed in a concealed fashion, then install the cable in conduit.
3. Install fire alarm cable in conduit in mechanical rooms, loading docks and similar service spaces.
4. Drops to surface mounted devices shall be installed in conduit or surface raceway. No exposed cable shall be visible below the ceiling. Where the ceiling is exposed, route the conduit or raceway up to the structural member that will conceal the cable.
5. Drops to devices recessed in partition walls shall be installed in conduit.
6. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
7. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits, if the system manufacturer permits it.

B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

D. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating
circuit differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

E. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum 1-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

F. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification."

B. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.4 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

C. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
D. Perform the following field tests and inspections and prepare test reports:

1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.

2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
   a. Include the existing system in tests and inspections.

3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.

4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
   a. Detectors that are outside their marked sensitivity range shall be replaced.

5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.6 PROGRAMMING

A. Coordinate final address descriptions for alarm, supervisory and trouble indication that appear on FACP and Annunciator displays with the Owners representative. This shall include all room names, room numbers, building areas for fire protection zones, exit door descriptions and similar items. This coordination shall take place and be implemented in the programming prior to Demonstration and Owner Training.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance
in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly, and one quarterly, periods.

C. Semiannual Test and Inspection: Six months after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

D. Annual Test and Inspection: One year after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, semiannual, and annual periods. Use forms developed for initial tests and inspections.

3.8 WARRANTY

A. All newly installed equipment shall be warranted by the contractor for a period of one year following acceptance. The warranty shall include parts, labor, prompt field service, pickup and delivery.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 16721
SECTION 16723 - SCHOOL INTERCOM AND PROGRAM EQUIPMENT

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. Provide new PA system speakers as indicated on drawings and connect to existing Rauland Telecenter PA system. Provide additional components and accessories as required. Coordinate work with Joe Samborski from Soundcom. Contact at 248-690-3700.

1.3 SUBMITTALS

A. Product Data: For the following:

1. System speakers.

B. Shop Drawings:
1. Equipment Details: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.

2. Wiring Diagrams: Power, signal, and control wiring. Include the following:
   a. Identify terminals to facilitate installation, operation, and maintenance.
   b. Single-line diagram showing interconnection of components.
   c. Cabling diagram showing cable routing.

C. Qualification Data: For Installer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For school intercom and program equipment to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:

1. Record of final matching transformer-tap settings and signal ground-resistance measurement certified by Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. Comply with UL 50.

E. The contractor shall be an established communications contractor that has had and currently maintains a locally run and operated business for at least five (5) years. The contractor shall utilize a duly authorized distributor of
the equipment supplied for this project location with full manufacturer’s five (5) year warranty.

F. The contractor shall show satisfactory evidence, upon request, that the supplies maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system.

1.5 COORDINATION

A. Coordinate layout and installation of system components and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Rauland-Borg Corporation.

2.2 PAGING AMPLIFIERS

A. Minimum Output Power: The system shall be sized at \( \frac{1}{2} \) watt per classroom, 1 watt per corridor speaker, and 3.5 watts per horn. The amplifier load shall not exceed 80% capacity.

B. Total Harmonic Distortion: Less than 1 percent at rated output power with load equivalent to total quantity of stations connected in all call mode.

C. They shall be designed to operate on a line voltage of 115 AC. One amplifier shall be provided for each audio channel.

D. Minimum Signal to Noise Ratio: 60 dB, at rated output.

E. Frequency Response: Within plus or minus 2dB from 50 to 12,000 Hz.
F. Amplifier Protection: Prevent damage from shorted or open circuit.

2.3 CEILING AND WALL MOUNTED SPEAKERS

A. Speakers shall be 8” in diameter seamless cone with 1-inch voice coil and minimum 5oz ceramic magnet. The frequency response shall be within plus or minus 3dB from 70 Hz to 15,000 Hz. It shall have an axial sensitivity of at least 95db at 4 feet with a 1-watt input.

B. The loudspeaker shall be complete with a 25-volt constant voltage transformer with power taps at ¼, ½, 1, 2, and 4 watts.

C. Ceiling speakers shall be flush mounted in suspended ceiling systems and surface mounted in exposed and unfinished areas. Assembly shall include a baffle constructed of 22 gage, cold rolled steel finished with a mar-resistant white, semi-gloss, epoxy coating. The baffle shall be 13” in diameter and include support bridge and speaker enclosure.

1. Where ceiling speakers are installed in exposed construction, provide speaker enclose suitable for surface mounting. Surface mount to structure or pendant mount as indicated. Paint speaker enclosure to match adjacent surfaces.

D. Wall mounted speakers shall be surface mounted. Assembly shall include a square 18 gage; cold rolled steel frame and 22-gage square speaker baffle used to enclose the 8” speaker described above. It shall be finished with a mar-resistant white, semi-gloss, epoxy coating.

2.4 CONDUCTORS AND CABLES

A. Conductors: Jacketed, twisted pair and twisted multi-pair, untinned solid copper. Sizes as recommended by system manufacturer, but not smaller than No. 22 AWG.

B. Insulation: Thermoplastic, not less than 1/32 inch thick.

C. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG tinned,
Part 3 - Execution

3.1 Installation

A. Wiring Method: Install wiring in raceways except within consoles, desks, and counters. Conceal cables and raceways except in unfinished spaces.

B. Wiring Method: Install wiring in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces. Use plenum cable in environmental air spaces, including plenum ceilings. Conceal cables and raceways except in unfinished spaces.

C. Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by J-hooks or similar fittings designed and installed to avoid damage to cables. Secure cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, or fittings.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess. Use lacing bars in cabinets.

E. Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.

F. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches for speaker microphones and adjacent parallel power and telephone wiring. Separate other school intercom and program equipment conductors as recommended by equipment manufacturer.
G. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

H. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

I. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

J. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.

K. Connect wiring according to Division 16 Section "Conductors and Cables."

3.2 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

C. Install grounding electrodes as specified in Division 16 Section "Grounding and Bonding."

3.3 SYSTEM PROGRAMMING

A. Programming: Fully train Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including
connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Schedule tests with at least seven days' advance notice of test performance.
2. After installing school intercom and program equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: Test originating station-to-station, all-call, and page messages at each intercom station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.
4. Frequency Response Test: Determine frequency response of two transmission paths, including all-call and paging, by transmitting and recording audio tones. Minimum acceptable performance is within 3 dB from 150 to 2500 Hz.
5. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
   a. Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio at paging speakers.
   b. Repeat test for three speaker microphones, one master station microphone, and for each separately controlled zone of paging loudspeakers.
   c. Minimum acceptable ratio is 45 dB.
6. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into each intercom, paging, and all-call amplifier. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.
7. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each paging zone. Maximum
permissible variation in level is plus or minus 3 dB; in levels between adjacent zones, plus or minus 5 dB.

8. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 150, 1000, and 2500 Hz. Maximum variation in power output at these frequencies is plus or minus 3 dB.

9. Signal Ground Test: Measure and report ground resistance at system signal ground. Comply with testing requirements in Division 16 Section "Grounding and Bonding."

C. Retesting: Correct deficiencies and retest. Prepare a written record of tests.

D. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging and independent room speaker-line matching transformers.

E. Prepare written test reports.

1. Include a record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

3.5 ADJUSTING

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

END OF SECTION 16723