ARCHITECTS:                                      ARCHITECTS GROUP LIMITED  
                                                 1825 SOUTH WEBSTER AVENUE, SUITE 202  
                                                 GREEN BAY, WISCONSIN 54301  
                                                 TELEPHONE: (920) 432-1232

MECHANICAL ENGINEER:                           FREDERICKSEN ENGINEERING, INC.  
                                                 12308 CORPORATE PARKWAY, SUITE 400  
                                                 MEQUON, WI 53092  
                                                 TELEPHONE: (414)781-9070

PLUMBING ENGINEER:                            MUERMANN ENGINEERING  
                                                 W227 N16867 TILLIE LAKE COURT  
                                                 JACKSON, WI 53037  
                                                 TELEPHONE: (262) 677-4588

ELECTRICAL ENGINEER:                          MUERMANN ENGINEERING  
                                                 116 FREMONT STREET  
                                                 KIEL, WI 53042  
                                                 TELEPHONE: (920) 894-7800

STRUCTURAL ENGINEER:                        AMBROSE ENGINEERING  
                                                 W66 N215 COMMERCE CT STE 100  
                                                 CEDARBURG, WI 53012  
                                                 TELEPHONE: (262)377-7602

CIVIL ENGINEER:                                POINT OF BEGINNING  
                                                 5709 WINDY DRIVE, Suite D  
                                                 STEVENS POINT, WI 54482  
                                                 TELEPHONE: (715) 344-9999

ADDRESS ALL COMMUNICATIONS REGARDING THIS WORK TO THE ARCHITECTS  
AT THE ADDRESS LISTED ABOVE.
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DIVISION 1-D - INVITATION FOR BIDS

The Wrightstown Community School District will receive mailed or hand delivered sealed Bids until **2:00 P.M., Local Time, on March 21, 2017**. Bids will be opened publicly and read aloud after 2:00 P.M. in the High School Community Room located across from the main entry Offices-Address is: Wrightstown High School 600 High Street, Wrightstown, and WI 54180. There will be a Non-Mandatory walk through scheduled between 2:15 to 3:15 P.M. on March 13, 2017-meeting to start at the High School Community Room.

Sealed Bids to be mailed shall be mailed to the attention of Wrightstown School Board, Wrightstown Community School District, 351 High Street, PO Box 128, Wrightstown, WI 54180. Sealed bids to be hand delivered shall be dropped off at Wrightstown High School 600 High Street, Wrightstown, and WI 54180. The outside of the envelope shall be marked with the name of Bidder and “Bid for Student & Community Wellness Center Addition to the High School, Wrightstown, WI.”. Bids will not the accepted if received after the above mentioned time. No facsimile or emailed copies will be allowed.

Proposals shall be received for ALL work under ONE LUMP SUM BID. The Lowest Three Competitive Base Bid Contractor Proposals shall be required to complete and submit, within 24 Hours of the Bid Opening, the Subs list found in the specifications booklet Div. 1-FF. This information will be kept confidential.

The work consists of a two story addition to the Wrightstown High School building consisting of approximately 11,103 Sq. Ft. on the First floor plus 7,461 Sq. Ft. on the second floor.

In general, the work consists of earthwork, concrete floors, footings and foundations, masonry walls, block and brick exterior walls, steel joists, roofing, interior finishes, Plumbing, HVAC and Electrical in accordance with the Contract Documents prepared by Architects Group Limited, 1825 South Webster Avenue, Suite 202, Green Bay, Wisconsin 54301, Telephone: (920) 432-1232.

The CONTRACT DOCUMENTS may be examined at the following locations: Architects Group Limited, 1825 South Webster Ave, Suite 202, Green Bay, WI 54301. Telephone 920-432-1232, the School District Office and at the following Plan Rooms: McGraw Hill/Dodge Reports, Fox Valley Builders Exchange and Milwaukee Builders Exchange.

Copies of the CONTRACT DOCUMENTS may be obtained after March 6, 2017 at the office of:

Blue Print Imaging Technologies
2201 So. Oneida Street, Suite 8
Green Bay, WI 54304
920-494-4539
Blue Print Imaging Technologies  
2350 W. Pershing Street  
Appleton, WI 54914  
1-800-640-4539

Plans and specs may also be viewed online at www.blueprintservice.com in the public planning room.

Upon payment of $50.00 for each set, a separate non-refundable check for $25.00 is required for each set mailed. Checks shall be made out to Architects Group Limited.

Any bidder, upon returning the CONTRACT DOCUMENTS within two weeks after the bid date, and in good condition, will be refunded the payment, and any non-bidder upon so returning the CONTRACT DOCUMENTS will be refunded $50.00.

The successful Bidders will be required to furnish and pay for satisfactory Performance Bond and Labor and Material Payment Bond, each in the amount of 100% of the Contract and to be executed on AIA Form A311 attached to Bid Documents.

Bid Form, Bid Bond, and Form of Non-Collusive Affidavit shall be furnished to each Bidder and shall be submitted with Bid. Failure to do so may be cause for rejection of bid. Copies of the above mentioned forms are in the specification book. State Wage Rates will NOT apply.

The WRIGHTSTOWN COMMUNITY SCHOOL DISTRICT reserves the right to reject ANY and all bids, or to waive informalities in the bidding. No bid shall be withdrawn for a period of 60 consecutive calendar days subsequent to the opening of bids without the owner’s consent.

No proposal will be accepted unless accompanied by a Bid Bond or Certified Check in the amount of not less than 5 percent of the total Base Bids, payable to the WRIGHTSTOWN COMMUNITY SCHOOL DISTRICT as a guarantee that if the bid is accepted, the bidder will execute and file the proposed contract and bonds within 10 days after the award of contract.

PUBLISHED BY AUTHORITY OF:
CARLA BUBOLTZ
DISTRICT ADMINISTRATOR

WRIGHTSTOWN COMMUNITY SCHOOL DISTRICT

* * * * * * *
Prior to execution of the Contract, the Bidder shall furnish the following Bonds:

- Performance Bond in the amount of 100% of the Contract.
- Labor and Material Payment Bond in the amount of 100% of the Contract.

Prior to execution of the Contract, a Certificate of Insurance form, A.I.A. Document G705 shall be completely filled out and fully executed.

Method of Award - Reservations:

If at the time of contract award, a qualified responsible Bidder, or Bidders, which does not exceed the amount of funds then estimated by the OWNER as available to finance the contract or contracts, the award will be made on the basis the following which will produce a net amount which is within the available funds:

Qualified Single Base Bid for the various Divisions of the Work as described hereinafter. (Exclusively of Bid Award, the OWNER shall use the Alternate Bids in his order of preference).

The OWNER reserves the right to reject all bids or any bid, or to waive any informalities in any bid, or to accept any bid which will best serve the interests of the OWNER.

INTERPRETATIONS

No oral interpretation will be made to any bidder as to the meaning of the Specifications and Drawings. Every request for an interpretation shall be made in writing and any inquiry received ten or more days prior to the date fixed for opening bids will be given consideration. Interpretations will be in the form of addenda which will be on file in the offices of the OWNER and the Architect at least seven days before bids are opened. In addition, addenda will be mailed to each bidder, but it shall be the bidder's responsibility to make inquiry as to addenda issued. All such addenda shall become a part of the contract and all bidders shall be bound by such addenda, whether or not received by the bidders.

"All interpretations of the Specifications and Drawings, request for substitutions, etc., shall be submitted, in writing, to the Architect, ten (10) days before Bid Opening date from the Prime General Contractors. The phrase "or approved equal" as noted in the Specifications means products of manufacturers not listed shall have all technical data submitted to the Architect ten (10) consecutive days before bid date for his review and approval. Any requests from suppliers, salesman, subcontractors, etc., will NOT be considered. If any of the above mentioned people have questions, the questions are to be directed to the Prime Contractors, who will in turn direct questions to the Architect".

* * * * *
DIVISION 1-F - BID FORM

BID FOR: FOR Student & Community Wellness Center Addition to the High School
WRIGHTSTOWN COMMUNITY SCHOOL DISTRICT
WRIGHTSTOWN, WISCONSIN

TO: CARLA BUBOLTZ
DISTRICT ADMINISTRATOR
WRIGHTSTOWN COMMUNITY SCHOOL DISTRICT
P.O. Box 128, 351 High Street, Wrightstown, Wisconsin 54180

DATE: March 21, 2017

TIME: 2:00 P.M., LOCAL TIME

The undersigned, having familiarized themselves with the local conditions, the Contract Documents (including Invitation for Bids, Instructions to Bidders, this Bid, the Form of Bid Bond, the Form of Non-Collusive Affidavit, the Form of Contract, and the Form of Performance and Payment Bond or Bonds, the General Conditions, the Supplementary Conditions, the Special Conditions, the General Scope of Work, the Technical Specifications, the Drawings (and the Addenda, issued), as prepared by Architects Group Limited, 1825 South Webster Avenue, Suite 202, Green Bay, WI 54301, and on file in the office of the Architects, hereby proposes to furnish all labor, materials, equipment services required to construct and complete the above mentioned project, ready for use, all in accordance therewith. See Instructions to Bidders, Article 5 and Special Conditions, for detailed description of bids. Modifying Bid Form will be reason for rejection of bid.

************************

BASE BID NUMBER 1: TOTAL ADDITION PROJECT

Provide all labor, materials, and equipment to complete ALL WORK of the project in strict accordance to these Specifications and Drawings.

FOR THE SUM OF

________________________________________

Dollars ($____________________________________)  

VOLUNTARY ALTERNATES: (Variations from Materials Specified)

The undersigned proposes the following voluntary alternates for materials and/or equipment specified, it being understood that, should any voluntary alternate(s) be accepted by the Owner, applicable amount(s) hereinafter listed will be added to or deducted from the Base Bid. (No voluntary alternates are required.)

Voluntary Alternate No. 1 ________________________________ $_________________ (Add/Deduct)
Voluntary Alternate No. 2 ________________________________ $_________________ (Add/Deduct)

Voluntary Alternate No. 3 ________________________________ $_________________ (Add/Deduct)

ACKNOWLEDGEMENT OF ADDENDA: The following Addenda have been received, are hereby acknowledged and their execution is included in the above proposal amount.

Addenda No. _____ Dated ________ Addenda No. _______ Dated ________

In submitting this Bid, it is understood that the right is reserved by the Owner to reject or accept any and all Bids. If written notice of the acceptance of the Bid is mailed, telegraphed or delivered to the undersigned within sixty (60) days after the opening thereof, the undersigned agrees to execute and deliver a contract in the prescribed form within ten (10) days after the contract is presented to him for signature.

BID SECURITY

Security in the sum of ________________________________ Dollars ($____________), in the form of ________________________________ is submitted herewith in accordance with the Specifications.

Date________________________, 2017

OFFICIAL ADDRESS: BY: ________________________

(SIGNATURE)

________________________ TITLE: ________________________

________________________

TELEPHONE NUMBER: ________________________

FAX NUMBER: ________________________

THE FOLLOWING DOCUMENTS ARE TO BE SUBMITTED WITH BID:

BID FORM
BID BOND
FORM OF NON-COLLUSIVE AFFIDAVIT
ADDENDA ISSUED (IF ANY)

*****
**DIVISION 1-FF – SUBS LIST**

This form shall be filled out and submitted by the THREE Lowest Competitive Base Bid Contractors within 24 Hours after the bid opening. This information will be kept CONFIDENTIAL by the Owner. List the Subcontractors Name and Dollar Value of their bid used in the General Contractors Base Bid.

<table>
<thead>
<tr>
<th>SUBS NAME</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC</td>
<td>Dollar Value $ __________</td>
</tr>
<tr>
<td>ELECTRICAL</td>
<td>Dollar Value $ __________</td>
</tr>
<tr>
<td>PLUMBING</td>
<td>Dollar Value $ __________</td>
</tr>
<tr>
<td>MASON</td>
<td>Dollar Value $ __________</td>
</tr>
<tr>
<td>ROOFER</td>
<td>Dollar Value $ __________</td>
</tr>
<tr>
<td>METAL ROOFING</td>
<td>Dollar Value $ __________</td>
</tr>
<tr>
<td>ALUMINUM WINDOWS</td>
<td>Dollar Value $ __________</td>
</tr>
<tr>
<td>FLOORING</td>
<td>Dollar Value $ __________</td>
</tr>
<tr>
<td>PAINTER</td>
<td>Dollar Value $ __________</td>
</tr>
<tr>
<td>EXCAVATOR</td>
<td>Dollar Value $ __________</td>
</tr>
<tr>
<td>SITE UTILITIES</td>
<td>Dollar Value $ __________</td>
</tr>
</tbody>
</table>

+++ END +++

AGL 2016-029 03/2017

SUBS LIST
DIVISION 1-FF-1
DIVISION 1-G - BID BOND

The “Bid Bond” is not bound in this Project Manual, but is included by this reference; is a part of the Bidding Documents, and is incorporated herein as fully as if herein set-forth. This Bid Bond will be used between Owner and each Prime Contractor.
DIVISION 1-H - FORM OF NON-COLLUSIVE AFFIDAVIT

AFFIDAVIT

(Prime Bidder)

State of ________) ss.
County of__________ )

__________________________, being first duly sworn, deposes and says:

That he is (a partner or officer of the firm of, etc.) _______ the party making the foregoing proposal or bid, that such proposal or bid is genuine and not collusive or sham; that said bidder has not colluded, conspired, connived or agreed, directly or indirectly, with any bidder or person, to put in a sham bid or to refrain from bidding, and has not in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference, with any person, to fix the bid price of affiant or of 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 Wrightstown Community School District or any person interested in the proposed contract; and that all statements in said proposal or bid are true.

Signature of:

______________________
Bidder, if the bidder is an
Individual;

______________________
Partner, if the bidder is a
Partnership;

______________________
Officer, if the bidder is a
Corporation.

Subscribed and sworn to before me this _____ day of______, 2017.

_____________________

* * * * *
DIVISION 1-I - PERFORMANCE/LABOR AND MATERIAL PAYMENT BOND

The “Performance/Labor and Material Payment Bond” is not bound in this Project Manual, but is included by this reference; is a part of the Bidding Documents, and is incorporated herein as fully as if herein set-forth. This Performance/Labor and Material Payment Bond will be used between Owner and each Prime Contractor.
DIVISION 1-J - FORM OF AGREEMENT

REFERENCED STANDARD AIA DOCUMENT

The "Standard Form of Agreement Between Owner and Contractor", AIA Document A101 - 2007, is not bound in this Project Manual, but is included by this reference; is a part of the Bidding Documents; and is incorporated herein as fully as if here set-forth. This Form of Agreement will be used between Owner and each Prime Contractor.

AIA Document A101 as supplemented, may be examined at the office of the Architect or at the Owner's place of business.

Copies of AIA Document A101 may be purchased from:

AIA Wisconsin
321 S. Hamilton Street
Madison, Wisconsin 53703
Telephone: 608/257-8477
Fax: 608/257-0242

* * * * *
The "General Conditions of the Contract for Construction", AIA Document A201 - 2007, is not bound in this Project Manual, but is included by this reference; is a part of the Bidding Documents; and is incorporated herein as fully as if here set-forth. This Form of Agreement will be used between Owner and each Prime Contractor.

AIA Document A101 as supplemented may be examined at the office of the Architect or at the Owner's place of business.

Copies of AIA Document A201 may be purchased from:

AIA Wisconsin
321 S. Hamilton Street
Madison, Wisconsin  53703
Telephone:  608/257-8477
Fax:  608/257-0242

* * * * *
DIVISION 1-L - SUPPLEMENTARY CONDITIONS

Article 15. Supplementary Conditions:

The General Conditions of the Contract for Construction (AIA Document A201, 1997 Edition, 14 Articles on 44 pages) are hereby made part of the Contract Documents whether bound herein or not. This Article 15 contains changes and additions to the AIA A201, cross referenced to the original Article numbers in AIA A201. Where any part of AIA A201 is not modified or voided by this Article 15, the unaltered part remains in effect.

Article 1. General Provisions:

1.1.5 Add: The general character and scope of the Work is shown by the drawings. Where a portion of the Work is fully drawn and the remainder is merely indicated, the portion fully drawn shall apply to all similar part of the Work.

Figured dimensions shall be followed in preference to scaled measurements. Dimensions on the drawings are subject to field verification to suit adjacent elements.

1.1.6 Add: Where Specifications are abbreviated type, they indicate complete sentences in the same manner as when a note occurs in the drawings. Omissions of words such as "the Contractor shall" and "as shown on the drawings" is intentional. The words "shall" or "shall be" are to be supplied by inference. The term "Provide" shall mean "furnish and install in place".

Where a number is listed in the Specifications (as for gauges, weights, temperatures, amount of time, etc.), the number shall be interpreted as that or better.

Article 2. Owner:

2.2.5 Delete Subparagraph 2.2.5 in its entirety and substitute the following:

The Base Bid Contractor will be furnished, free of charge, the copies of Drawings and Project Manuals in the amount owner had printed up for bidding purposes. Additional sets can be furnished at the cost of reproduction, postage and handling. Checks shall be payable to Owner for additional printing costs.
Article 3. Contractor:

Add: 3.1.1 Definition

a) Where referred to as Prime Contractor, Contractor, Base Bid Contractor, or General Contractor, means the contractor under contract with the Owner.

Add: 3.4.4 Workmanship and Materials.

a) No trade shall commence Work until conditions are right for carrying out the Work properly, and surfaces to be covered are suitable.

b) Manufacturer's printed instructions covering details of installations shall be followed where not in conflict with these Specifications. If there is a conflict, notify the Architect and obtain his approval before proceeding.

c) Completed Work shall be left plumb, level, true to line or plain, anchored securely in place free from damage.

d) Unless otherwise called for, all pieces of materials shall be as large a stock size as is in conformity with standard good practice of the trade.

e) Except where in conflict with these specifications, current manufacturer's printed specifications of herein specified proprietary products are made part of these specifications.

Add: 3.4.5 After the Contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only by written Change Order and according to conditions set forth in the General Conditions.

Add: 3.4.6

By making requests for substitutions based on Clause 3.4.5 above, the Contractor:

(a) represents that he has personally investigated the proposed 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 the Architects' re-design costs, and waives all claims for additional costs related to the substitution which subsequently became apparent, and;

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

3.7.1 Add: General Contractor is to pay for the building permit, all other contractors are to pay whatever permits and fees are required for their work.
3.10.1 Add: The Contractor with the largest Contract shall prepare the progress schedule in cooperation with the other prime Contractors and obtain written evidence of their concurrence. The first payment will not be certified by the Architect until the progress schedule is received by him.

3.11.1 Replace the text with: The Contractor shall maintain at the site one record copy of the Drawings, Specifications, addenda, approved Shop drawings, Change Orders and other modifications. These shall be available to the Architect during construction. One set of prints shall be kept in good condition and marked as the Work progresses by the Contractor in ink to show all difference of major concealed items from what is called for by the Contract Documents. This is to include such items as main pipes and conduit or changed structural members which cannot be observed on completion even with the use of access doors or removable panels. This set shall be delivered to the Architect at the time of final inspection for submittal to the Owner.

Add 3.12.5.1:
The Contractor shall submit to the Architect, six (6) sets of Shop Drawings for any pre-fabricated items. Contractor shall submit one set of sepia drawings and two sets of prints for all shop drawing pertaining to structural systems specified in Divisions 3, 5 or 6. Contractor shall make all efforts to submit shop drawings within forty five (45) days of contract signing. If any shop drawings cannot be submitted in time, contractor shall submit a delivery schedule for the drawings and material involved.

Shop Drawings required includes, but is not limited to, the following items:

03 31 50  Concrete Mix Design
03 41 00  Precast Concrete
05 12 00  Structural Steel and Metal Framing
05 21 00  Steel Joists
05 31 00  Steel Deck
05 50 00  Metal Fabrications
06 20 00  Finish Carpentry
06 41 00  Custom Casework
07 24 00  Exterior Finish System
07 25 00  Weather Barriers
07 25 10  Sprayed on Fireproofing
07 31 16  Metal Shingles
07 53 00  Flexible Sheet Roofing - Fully Adhered
07 62 00  Metal Fascia and Coping
07 70 00  Roof Hatch
07 81 00  Applied Fireproofing
07 95 13  Expansion Joint Covers
08 11 00  Steel Doors and Frames
08 21 00  Wood Doors
08 41 20  Framed Window Glazing
08 71 00  Finish Hardware
10 16 00  Toilet Partitions
10 50 00  Lockers
10 52 20  Fire Extinguisher Cabinets
10 80 00  Toilet and Miscellaneous Accessories
10 83 00  Mirror Units
Division 22  Plumbing Work
Division 23  Heating, Ventilating and Air Conditioning
Division 26  Electrical

Add:3.12.5.2 The Contractor shall submit to the Architect color samples (within 30 days of Contract Signing). This includes, but is not limited to the following items:

- Stair Treads
- Sealants
- Vinyl Base
- Paint
- Stain
- Cabinets and Tops
- Acoustical Ceiling Tiles and Grid
- Brick and Split Faced Block Samples
- Aluminum Window Color
- Toilet Partition Colors
- Porcelain Tile and Ceramic
- Exterior Finish System
- HVAC Louvers
- Wood Doors
- Resilient Rubber Flooring
- Roof Copings
- Metal Shingles
- Electric Water Coolers
- Aluminum Copings
- Lockers
- HVAC Convector, Baseboard
- Solid Surfacing Materials

Article 4. Administration of the Contract:
4.2.3. Add: The Architect will not be responsible for the acts or omissions of the Owner.
4.2.4 Add: If there are any direct communications between Owner and Contractor, that affect the performance or Administration of the Contract, the gist of such communication shall be reduced to writing by the Owner, with a copy to the Architect.

4.2.12 "In case of discrepancy between drawings, specifications, and/or existing conditions, contractor shall notify the Architect for a decision prior to final date of last Addenda to be issued. Architect will incorporate in an Addendum. In discrepancies on the drawings, the larger detail governs. In discrepancies between specifications and drawings. If Architect is not notified, and clarification made in Addenda, contractor shall use the larger quantity or better quality in his bid.

Article 6.2 - Mutual Responsibility: Add the following: Costs of repairing damage that cannot be traced to any person responsible for it shall be prorated among all the prime contractors on the building, in proportion to their activities in the building at the time the damage was done, and/or their contract amount.

Article 7. Changes in the Work: Add: In Subparagraph 7.3.6, the allowance for the combined overhead and profit included in the total cost to the Owner shall be based on the following schedule:

1) For the Contractor, for Work performed by the Contractor's own forces, 15 percent of the cost.
2) For the Contractor, for Work performed by the Contractor's Subcontractor, 7-1/2 percent of the amount due the Subcontractor.
3) Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.
4) In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also.
5) Contractors mark up percentages noted above is predicated only on the total amount after addition and deduct costs are calculated.

Article 8. Time:

8.1.3 Add: Minor corrective Work and the replacement of defective Work or materials, and the adjustment of control apparatus will not delay the determination that the Contract is Substantially Complete. See 12.2.2.

8.3.1 Add: the following will not be considered justifications for extension of time unless due to one of the causes stated within this article 8.

a) Delay caused by Subcontractors or Supplier except if the Supplier goes out of
business and another Supplier cannot be found in time to meet schedule.

b) Shortage of workmen.

**Article 9. Payments and Completion:**

9.3.1 Application for Payment shall be received in triplicate in the office of the Architect by the first of each month. Each application must be notarized.

9.3.2 Add: Before payment is made to Contractor for materials stored offsite, materials shall be stored in a bondable warehouse located twenty miles maximum from Wrightstown, Wisconsin with the Owner named as beneficiary.

**ADD THE FOLLOWING TWO CLAUSES:**

9.3.4 Until final payment, the Owner will pay ninety percent (90%) of the amount due the Contractor on account of progress payments. If the manner of completion of the Work and its progress are and remain satisfactory to the Architect, and in the absence of other good and sufficient reasons, for each Work Category shown to be fifty percent (50%) or more complete in the Application for Payment, the Architect will, without reduction of previous retainage, on presentation by the Contractor of Consent of Surety for each application, certify any remaining progress payments for each Work category to be paid in full.

9.3.5 The full Contract retainage may be reinstated if the manner of completion of the Work and its progress do not remain satisfactory to the Architect or if the Surety withholds his consent, or for other good and sufficient reasons.

9.8.2 Add: Minor Punch list items that do not interfere with using the Work as intended may be corrected between Substantial Completion and Final Completion.

9.8.3 Add: At 12:01 a.m. on the date of Substantial Completion, the Owner becomes responsible for the care and operation of the accepted Work.

9.10.2 Add to this paragraph the following: "Prior to receiving final payment, each employer must file an affidavit with the Superintendent stating that all provisions and requirements of s.66293(3) Stats., have been complied with and that the employer has received similar evidence of compliance from all of its agents and subcontractors. No municipality may authorize the final payment to an employer until an affidavit is filled in proper form and order. A copy of the Affidavit will be handed out at Preconstruction Meeting.

**Article 11. Insurance and Bonds:**

11.1.1 Contractor's Liability Insurance
Minimum Limits specified can be obtained either through the basic policies or in conjunction with
A. Compensation Insurance
   1) Workmen’s Compensation Insurance as required by statute for all his employees engaged in work of the project. Contractor shall require subcontractors to provide Workmen's Compensation Insurance for all the latter's employees engaged in such work unless they are covered by the Contractor's Workmen's Compensation Insurance. Limits shall Coverage A: Statutory. Coverage B: Employers Liability Limits. $100,000 each accident, $500,000 policy limits and $100,000 each employee.

   2) If any class of employees engaged on the project is not protected under the Workmen's Compensation Statute, Contractor shall provide and shall cause each subcontractor to provide adequate employer's liability insurance for the protection of such employees, with limits same as above.

B. Contractor's Commercial General Liability Insurance:

   1) Minimum Limits of Insurance

<table>
<thead>
<tr>
<th>Minimum Limits of Insurance</th>
<th>Base Bid #1</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Aggregate Limit</td>
<td>$5,000,000</td>
</tr>
<tr>
<td>(Other Than Products</td>
<td>2,000,000</td>
</tr>
<tr>
<td>-Completed Operations</td>
<td></td>
</tr>
<tr>
<td>Products-Completed Operations Aggregate Limit</td>
<td>$5,000,000</td>
</tr>
<tr>
<td></td>
<td>2,000,000</td>
</tr>
<tr>
<td>Personal &amp; Advertising Injury Limit</td>
<td>$5,000,000</td>
</tr>
<tr>
<td></td>
<td>2,000,000</td>
</tr>
<tr>
<td>Each Occurrence Limit</td>
<td>$5,000,000</td>
</tr>
<tr>
<td></td>
<td>2,000,000</td>
</tr>
<tr>
<td>Fire Legal Limit</td>
<td>$ 50,000</td>
</tr>
<tr>
<td></td>
<td>50,000</td>
</tr>
</tbody>
</table>

   2) Contractor's Commercial General Liability Insurance shall include products, independent contractors complete operation, and contractual liability. Contractual liability coverage shall be carried in substantially the following form: "The insurance shall in all instances, save, defend, indemnify and hold harmless the Owner and the Architect/Engineer against all claims, demands, liabilities, damages or any other costs which may accrue in the prosecution of the work and that he will save, defend, indemnify and hold harmless the Owner and the Architect/Engineer from all damages caused by or as a result of the Contractor's operations." Note: Form should be on an Occurrence Basis, not Claims-Made Basis.

   3) The obligations of the Contractor listed above in paragraph (b) shall not extend to the liability of the Architect/Engineer, his agents or employees arising out of (1) preparation or
approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications or (2) giving of or failure to give directions or instructions by the Architect/Engineer, his agents or employees provided such giving or failure to give is the primary cause of the injury or damage.

4) In addition to the insurance listed above, the Contractor shall carry Business Automobile Liability insurance covering owned, non-owned and hired automobiles for bodily injury and property damage combined single limit of $1,000,000, limits listed above.

5) Contractor shall either (1) require each of his subcontractors to procure and to maintain during the life of his subcontract, Subcontractor's Public Liability Property Damage Insurance, and Comprehensive Automobile Liability insurance of the type and in the same amount specified in the preceding paragraphs or (2) insure the activities of his subcontractors in his own policy.

6) Insurance required under Paragraph (2) shall provide adequate protection for the Contractor and his Subcontractors, respectively, against damage claims which may arise from operations under this Contract, whether such operations be by the insured or by anyone directly or indirectly employed by him and also against any of the special hazards which may be encountered in the performance of this contract.

7) Contractor shall furnish the Architect with certificates showing the type, amount, class of operations covered, effective dates and dates of expiration of policies. Such certificates shall also contain substantially the following statement: "The insurance covered by this certificate will not be cancelled or materially altered, except after thirty (30) days written notice has been received by the Owner".

8) Contractors Insurance to list Wrightstown School District, Architects Group Limited as additional insured.

11.3.1 Builders Risk Insurance

C. The Owner shall effect and maintain Builder's Risk Insurance on above ground structures by providing a Multi-Peril Form Policy. This policy shall be written on a completed value basis, with a limit equal to 100% of the completed value of all work of above ground structures excluding cost of excavation, footings, foundations, backfilling, and grading. The policy must insure against "All Risk" of direct physical loss or damage to the property insured. Policy shall be extended to include coverage for theft, (including theft of building materials), collapse, and damage to property while in transit, or at any temporary locations. Policy shall be written in the name of the Owner, Architect, Engineers, all Contractors, all subcontractors and sub-subcontractors as their interests may appear. The contractor shall obtain installation floater on below ground structures and related equipment on this project. Property coverage will be on a replacement cost basis. All risk coverage, including water damage.
11.3.1.3 Add the following: If by the terms of this insurance, The Owner will have a $5,000.00 deductible and the contractor shall purchase insurance to cover this deductible or pay the amount in the event of any claims under $5,000.00.

Article 13. Miscellaneous Provisions:

13.1.1 Add: Where the Contract Documents require Work better than that required by statute, the Contract Documents shall govern.

By special request of the Owner, the following shall be incorporated into the Documents:

Article 4.5
Arbitration: The Owner and/or contractor may reserve the right to pursue litigation of any disputed contract issues should they occur as an option in lieu of arbitration which is referred to in the Contract Documents.

* * * * *
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44. American Made Equipment and Products

1. **PROJECT SITE:**
The Project is an addition to the High School located at 600 High Street, Wrightstown, WI 54180 Highway 96 in the Village of Wrightstown.

2. **TIME FOR COMPLETION:**
The successful bidder must agree to sign contracts the beginning of April 2017, submit shop drawing submittals for material approvals and ordering with the idea of starting work in the spring of 2017 when weather permits and completing work 32 weeks later (224) calendar days.

3. **LIQUIDATED DAMAGES:**
   NOT APPLICABLE.

4. **COMMUNICATIONS:**
   All notices, demands, requests, instructions, approvals, Bids, claims, must be in writing.

   Any notice to or demand upon the contractor shall be sufficiently given if delivered at the office of the contractor stated on the signature page of the Contract or at such other office as he may from time to time designate, in writing, to the OWNER or deposited in the United States mail in a sealed, postage-prepaid envelope, or if delivered with charges prepaid to any telegraph company for transmission, in each case addressed to such office.

   All papers required to be delivered to the OWNER shall, unless otherwise specified, in writing, to the contractor, be delivered to Carla Buboltz, District Administrator, P.O. Box 128, 351 High Street, Wrightstown, Wisconsin 54180 and any notice to or demand upon, the OWNER shall be sufficiently given if so delivered, or deposited in the United States mail in a sealed, postage-prepaid envelope, or delivered with charges prepaid to any telegraph company for transmission to OWNER at such address, or to such other representatives of the OWNER or to such other address as the OWNER may subsequently specify in writing, to the contractor for such purpose.

   Any such notice shall be deemed to have been given as of the time of actual delivery; or, in the case of mailing, when the same should have been received in due course of post, or, in the case of telegrams, at the time of actual receipt.

5. **SIGNS:**
Subject to prior approval of the OWNER as to size, design, type and location, and to local regulations, the Prime Contractor and his subcontractors may erect temporary signs for purposes of identification and controlling traffic. The Prime Contractors shall furnish, erect and maintain such signs as may be required by safety regulations and as necessary to safeguard life and property.

   No project sign required.
The General Contractor shall install architects 4 x 4 ft. sign on site per OWNER and Architects directions. Contractor shall remove and return sign to architects at completion of job. Architect will furnish sign to contractor to install.

6. OPTIONS:
Permissible options with respect to the items in Specifications shall be at the option of the bidder wherever applicable to the work included in his bid, whether such bid be for prime or for subcontract work.

Where on the Drawings or in the Specifications, acceptability of optional materials, or methods, it shall be the privilege of a contractor or subcontractor to utilize those which best suit his purpose in the performance of his work, only as approved by the Architect. Requested options shall be submitted to the Architect, in writing, from the Prime Contractor for approval. A Change Order will be issued for the acceptable options.

7. WORK BY OTHERS:
All notes on Drawings - "N.I.C." means "Not In Contract". The OWNER will arrange for work done by others. Co-operation and co-ordination by contractors may be required. OWNER will arrange for security system and telephone system and data cabling. Owner will provide and install all fire extinguishers, room signage and numbers. Owner will provide and install toilet room accessories such as toilet paper holder, towel dispensers, waste receptacles and soap dispensers.

8. FACTORY PREFABRICATION: NOT APPLICABLE

9. TAXES
Prime Contractors and Subcontractors are NOT to include Wisconsin Sales Ta in their Bid Work associated with school addition/remodeling work.

10. JOB OFFICES:
The Prime Contractors and his subcontractors may maintain office space near the building addition and storage facilities on the site as may be necessary in the proper conduct of the work. These shall be located so as to cause no interference to any work to be performed on the site. The Owner shall be consulted with regard to locations.

Upon completion of the project, or as directed by the Owner, the Prime Contractor(s) shall remove all such temporary structures and facilities from the site, same to become his property, and leave the premises in the condition required by the Contract.

Contractor to have a plan, specification, and shop drawing file available for Architects and Owners use on site.

Temporary toilet facilities for the use of construction workers shall be provided and maintained at construction site during the period of construction by the General Contractor.
11. **EXAMINATION OF SITE:**
Bidders are requested to visit the site, compare the Drawings and Specifications with any work in place, and inform themselves of all conditions, including other work, if any, being performed. Failure to visit site will in no way relieve the successful bidder from necessity of furnishing any materials or performing any work that may be required to complete work in accordance with Drawings and Specifications, without additional cost to the OWNER.

12. **LAYOUT OF WORK:**
Employ competent surveyor to lay out work; be responsible for its accuracy. Locate all general reference points and take such action to prevent their destruction or dislocation; lay out own work and be responsible for all lines, elevations, and measurements of building, grading, utilities and other work executed under this contract. Exercise precaution to verify figures shown on drawings before laying out work. Contractor will be held responsible for any error resulting from his failure to exercise such precaution. Contractor shall verify all elevations affecting the work of this contract.

13. **RECORD SET OF DRAWINGS**
The Contractor shall keep one set of prints in good condition on which he shall keep a record of any and all changes in the work for all trades. Wherever there is a deviation from Plans or Specifications during the progress of the work, the Contractor shall furnish the inspection personnel with all necessary records and supply written report of any such change in the work. Such records shall include the extent of the work, whether or not this change was a part of a written Change Order to the work, the date of the change and quantities of material and labor involved in making such a change in the work. Contractor shall also keep current record drawings marked with any changes to the work and, upon completion of the project; a copy of this record shall be furnished to the OWNER.

14. **TEMPORARY ENCLOSURES AND DUST BARRIERS:**
The General Contractor shall: 1) Construct temporary walls as required to protect contents and to separate the interior enclosed sections from the interior open section of the building during construction. Temporary wall enclosure shall consist of plywood panels, at least 3/8" thick, fastened to wood frame work, consisting of 2x4 studs spaced 24" o.c., securely spiked to wood plates, top and bottom. Provide intermediate girts between studs as required for fastening of plywood. Temporary walls must provide protection from dirt, dust and drafts. 2) Provide doors with hinges, self-closing device and locks. 3) Make suitable provisions for passage of air to permit proper drying out of the building.

At end of day's work, securely close temporary enclosures, padlock doors. General contractor shall supervise effectiveness of enclosures.

Enclosures and dust barriers shall be located so as to maintain public passageways open that lead directly to grade.

General Contractor shall be solely responsible for security within renovated space. OWNER shall be responsible for security not under renovated portions of building.
15. **TEMPORARY HEATING**
A. General Contractor shall, at his own expense, provide temporary heating as required for the protection and drying all work. Temporary heat shall be provided as required by the specified division in the technical specifications, by manufacturers recommendations and as directed by the Architect from November 15th to April 15th in addition to when conditions dictate. Contractor shall erect temporary enclosures as required and maintain a minimum temperature of 35 degrees F. Once the building has been enclosed, temperature inside shall be maintained at minimum 45 degrees. The General Contractor shall pay for temporary heating fuel and shall coordinate with HVAC contractor for having W.P.S. provide natural gas service to building. If natural gas is not available when needed, then the General Contractor shall provide L.P. gas as a fuel source. The HVAC Contractor is responsible for temporary heating units as noted in Paragraph C. in order to maintain 45 degree temperature during construction.

When temporary heating is no longer required, or as soon as the permanent heating system may be used, the General Contractor shall arrange for dismantling the temporary heating system and shall, at his own expense, operate the permanent heating system, assuming all responsibility therefore until the project is completed and accepted. Once flooring has been installed building shall be maintained at minimum 55 degrees, or higher, as recommended by product manufacturers. Permanent heating system shall not be used for temporary heating and not turned on until building is clean of construction dust.

B. Temporary heat is intended to protect all elements of construction which are affected by frost in the ground and any application of materials effected by lack of heat such as drywall taping, painting, wiring or plumbing traps. Temporary heating units shall be provided and vented as required to meet the requirements listed.

C. Temporary heating units, fuel piping, and venting shall be provided and installed by HVAC Contractor as directed by the General Contract.

16. **TEMPORARY LIGHT AND POWER:**
The Electrical Contractor will provide all temporary electric services to the site with 120/240 volt and 200 amp single phase and illumination of sufficient amperage necessary for carrying forward the work. Extension cords and lamps will be the responsibility of the various Divisions of work. The General Contractor shall pay for all electric consumption until the project is complete and accepted. If a contractor requires 3 phase temporary service, that contractor shall be responsible for obtaining and paying for this service.

17. **TEMPORARY TELEPHONE:**
Do not use the OWNERs phone. Contractors to use cell phones.

18. **TEMPORARY WATER AND DRAINAGE:**
Provide temporary drainage pumps for pumping excavations; maintain pumps to provide proper
working conditions, and keep entire project free of water at all times. Cost shall be paid by contractor or subcontractor requiring drainage system.

The OWNER shall pay cost of water used for construction.

The General Contractor shall co-ordinate with Plumbing Contractor to make available all temporary connections and water required for construction.

19. PROTECTION OF WORK AND PROPERTY:
General Contractor: Water protection: Always protect excavation trenches, all parts of the site and building from damage from rain water, spring water, ground water, backing up of drains, etc.

Weather Protection: Provide constant protection against rain, wind, storms, frost or heat so as to maintain work, materials, apparatus, and fixtures, free from injury or damage. At end of day's work, cover work likely to be damaged.

Contractors Other Than General: Protect own materials, work and equipment.

All Contractors: Equipment or material damaged by failure to provide protection shall be removed and replaced with new equipment or materials, at Contractor's expense.

Protection of Other Property: Protect trees, shrubs, lawns, landscape work, from damage, and provide guards, covering. Repair or replace damaged work.

20. JOB CLEAN UP AND CONSTRUCTION WASTE MANAGEMENT:
Each Contractor shall be responsible for the removal of all debris caused by its work from the job site. All areas of the site must remain clean and safe of debris to the satisfaction of the OWNER and the Architect. Once a week, all Trades shall clean up their respective work areas, and leave floors broom clean. Contractors to coordinate amongst themselves and designate a day per week all Trades will clean up. If standards are not met to the OWNER/Architect satisfaction, the OWNER/Architect will direct others to clean up to assure such standards at the expense of the Prime Contractor involved with the offense. The General Contractor shall provide dumpster on site for debris removal. Do not use OWNERs dumpsters.

All contractors shall reduce, reuse, salvage and or recycle construction waste to the greatest extent feasible. As a minimum, the following items are proposed to be salvaged, reused, or recycled:

- Cardboard
- Concrete/Masonry
- Metals (banding, steel, iron, aluminum)
- Acoustical ceiling tile

At the completion of the project, the Prime Contractor to submit a summary of materials indicating quantity of material recycled, reused, or salvaged along with an weight tickets, receipts, invoices that can be reviewed by the OWNER.
21. **GUARANTEE - WARRANTY**
One year from date of substantial completion, unless specified elsewhere in these specifications. Items specified elsewhere shall include, but are not limited to: Landscaping, wood doors, insulating glass, steel doors.

In cases of work performed by subcontractors, secure warranties from said subcontractors addressed to and in favor of, the OWNER.

Deliver copies of same to the OWNER upon completion of work. Delivery of said guarantees shall not relieve Contractor from any obligation assumed under any other provision of contract. Manufactured articles, materials, equipment: applied, installed, connected, erected, used, cleaned, conditioned as per manufacturer's printed directions, unless specified to the contrary.

22. **PERMITS, CODES AND FEES:**
The Prime Contractor shall give all notices and comply with all applicable laws, ordinances, codes, rules and regulations. The intent of his contract is that all work installed shall comply with all applicable codes and regulations, as amended by any waivers. All work not complying shall be done at the expense of the Contractor.

Where codes and standards are referred to, they shall be current approved copies. It shall be the duty of the supplier of any material on this work to submit evidence, if required, that his material is in compliance with the applicable local and state codes and standards, in the method in which the material is used.

The Prime Contractors shall submit their base bids in accordance with specifications. If specifications do not comply with any codes or utility company requirements having jurisdiction, then Prime Contractors shall notify Architect not later than ten (10) days before bid opening so that an addendum can be issued to all bidders by the Architect.

Permits and Fees: Before any work is started or materials purchased or purchase commitments made, Prime Contractor shall first take out and pay for all permits, licenses and fees as specifically detailed and required under the Building or Zoning Ordinances of the Municipality or the legal authority having jurisdiction. Copies of all such permits, etc., shall be submitted to OWNER with Contract.

23. **CHANGES IN THE WORK**
The OWNER will execute all Change Orders for changes in the work as ordered. No payment will be made to the Contractor until a properly executed Change Order has been prepared and approved.

24. **CONFLICT BETWEEN PLANS, SPECIFICATIONS AND GENERAL CONDITIONS:**
In case of discrepancy between drawings, specifications, and/or existing conditions, contractor shall notify the Architect for a decision prior to final date of last Addenda to be issued. Architect will incorporate in an Addendum. In discrepancies on the drawing, the larger detail governs.
discrepancies between specifications and drawings, the specifications govern. If Architect is not notified, contractor shall use the larger quantity or better quality in his bid.

In case of conflict between General Conditions and this Section, contact the Architect for his interpretation before bidding.

Where conflict occurs between plans and specifications and not reconciled by addenda, the installation of the greater quantity or better quality shall be provided.

25. PROJECT LIMIT LINE OR "SITE AREA DEFINITION"
See Site Plan for project contract limit line. Any construction related damage including construction access and storage, and installation of utilities, shall be returned to its original condition.

26. PAYMENTS AND COMPLETION:
See General Conditions, Article 8 and Supplementary Conditions.

27. PROJECT MEETINGS:
Description

The Architect shall: schedule and administer a Pre-Construction meeting and specially called meetings throughout the progress of the work.

Prepare agenda for meetings.

Preside at meetings.

Record the minutes; include all significant proceedings, decisions and agreements (or disagreements) reached.

Reproduce and distribute copies of minutes within three (3) days after each meeting.

(a) To all participants in the meeting.

(b) To all parties affected by decisions made at the meeting.

Representatives of prime contractors, subcontractors and suppliers attending the meetings shall be qualified and authorized to act on behalf of the entity each represents.

Architect will ascertain that work is expedited consistent with Contract Documents and the construction schedules.

Progress Meeting (if required)

The following persons or their authorized representatives shall attend initial and each progress meeting:

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a) OWNERs Representative.
b) Architect and his consultants (as required).
c) Prime contractor.
d) Subcontractors who are in need of or have pertinent information.

Initial meeting shall be provided for general review of Drawings and specifications. In addition to the above required participants, the prime contractor's job superintendent and the job foremen for each and every subcontractor shall attend the initial meeting.

Progress meetings shall be held at the direction of the Architect no less than once a month throughout the entire construction period. Exact day and time shall be determined by mutual agreement. Progress meetings shall be held at the site.

Chairman of progress meetings; Architect or his authorized representative.

Minutes of progress meetings; Architect shall take minutes, prepare and distribute one copy each to the OWNER, the Architect and Prime Contractor. One bound volume of all progress meetings shall be maintained by the contractor in the job office until project completion.

28. LIST OF DOCUMENTS:
Following is a list of Documents to be completed and used by the Prime Contractor during the administration of this Contract. Architect will distribute copy at preconstruction meeting.

   AIA Document G702 Application and Certificate for Payment
   AIA Document G703 Continuation Sheet
   AIA Document G704 Certificate of Substantial Completion
   AIA Document G706 Contractors' Affidavit of Payment of Debts and Claims
   AIA Document G706A Contractors' Affidavit of Release of Liens
   AIA Document G707 Consent of Surety Company to Final Payment

29. TRUCKING:
All Trades trucking materials to the site shall observe road load limits as set by authorities controlling same.

30. OPERATING INSTRUCTIONS:
Prime Contractor or subcontractor furnishing or installing operating equipment hereunder, or materials which require particular care and maintenance, shall file with the OWNER upon completion of his work or before, as may be requested, complete instructions, in triplicate, reciting the name and address of manufacturer or producer, date of installation and all pertinent advice as to producer, date of installation and all pertinent advice as to proper operation, care, maintenance, and
sources of repair parts and the name of any local agent who can service operating equipment or apparatus, all bound in hard cover. All Contractors shall instruct OWNER or his representative in use of all equipment verbally and in written form.

31. PUNCH LIST:
The Architect/Engineer will prepare a Punch List only after the work is complete and the Prime Contractor has notified the Architect that the project is ready for review. The Prime Contractor(s) shall do all corrective work immediately (within two weeks) after receiving the list. The Prime Contractor shall be responsible for his own and all other work assigned to him. If the corrective work is not completed immediately, 2-1/2 times the actual value of the work will be deducted from the contract and the work will be done by others. Reinspection Procedure: The Architect will reinspect the work upon receipt of notice from the contractor that the work has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect. 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 been not fulfilled and are required for final acceptance. If additional reinspection trips are required after the first reinspection, each prime contractor whose work is reviewed will be billed to cover the Architects and OWNER's expense.

32. CUTTING AND PATCHING:
Each trade for the respective branches of the work shall remove or remodel existing work applicable to that respective branch of the work to the extent shown on the drawings or included in the specifications.

1. Each trade shall do cutting required to install his work.

Each contractor shall repair and unify all work cut in the process of remodeling to match existing.

1) Patching shall be accomplished by experienced trades for the work involved.

Where remodeling work adjoins existing work that remains, new work shall match existing work including all finishing required.

Where the work requires removal of materials, these materials become the property of the effected Trade and shall be removed from the site unless noted otherwise.

All present services installed and operating shall be kept in operation through the new construction until equal new services or temporary lines are installed and operating. Services removed during remodeling shall be rejoined by the use of new materials.

33. ARCHITECTS FIELD OBSERVATION:
The Architect will endeavor to observe and to check work but omissions, failures to provide proper material and failure to perform work correctly are totally the responsibility of the Contractor. The Prime Contractor, not the Architect, is responsible for determination that all work under his Contract
as it proceeds or as complete is performed and installed in accordance with the Specifications and governing regulations. Where laws, codes or standards require supervision or inspection of portions of the "Contractor's work by an Architect, Engineer or other competent or qualified person, it is the Prime Contractor's responsibility to furnish such supervision and/or inspection to the satisfaction of the governing authority and without cost to the OWNER. Such requirements shall in no way be the responsibility of the Architect or his field representative.

1) DEFINITION, Supervision of construction is a professional service, as distinguished from superintending of construction by a contractor, and means the performance, or the supervision thereof, of reasonable on-the-site observations to determine that the construction is in substantial compliance with the approved plans and specifications.

34. CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES:
Immediately after execution and delivery of the Contract, and before the first partial payment is made, the General Contractor (hereafter call the Prime Contractor) shall prepare and deliver a construction progress schedule in a form satisfactory to the Architect.

The construction progress schedule shall include, as a minimum, the following:

1) Submission dates for all detail and Shop Drawings.
2) Procurement and delivery dates for all equipment and material.
3) Weekly definition of extent of work and areas of activity for each trade or Subcontract.
4) Intended time for starting and completing each activity, including indication of float or slack time.
5) Clear identification of activities which are critical to maintenance of schedule.

Progress schedule shall be maintained current at all times. Revisions to progress schedule shall be made in the same detail as the original, shall be accompanied by an explanation of the reasons for the revision and shall be subject to approval by the Architect and the OWNER.

The General Contractor shall also furnish on AIA Form G702 and G703 (a) a detailed estimate giving a complete breakdown of the contract price and (b) periodic itemized estimates of work done for the purpose of making partial payments thereon. The costs employed in making up any of these schedules will be used only for determining the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the contract price.

35. CO-ORDINATION OF TRADES
Sections of these specifications set down guidelines as to the extent of work by subcontractors. These guidelines are set forth to aid in the bidding process and help with estimating trade payment breakdowns and monthly payment requests only.

The Prime Contractor is responsible for the administration of all subcontractors and therefore is not obligated to the work categories listed herein. The Prime Contractor must provide a total and
complete project and thus may divide the work between sub trades as he feels is most efficient and economical to provide a complete project.

The Architect is not responsible for providing complete coverage of work between sub trades in the work descriptions of the technical sections of the specifications. Therefore, the Architect will not arbitrate or even discuss overlapping or voids that occur in scope of work between sub trades. The Prime Contractor shall solely handle all problems of this type that deal with which sub trade will take care of which items of work.

The Prime Contractor(s) shall coordinate all sub trades regardless of the specification headings under each specification Division assigned to him and shall make all necessary provisions for accommodation of all equipment and fittings into the building and patching after necessary. The Prime Contractor(s) shall coordinate all material delivery, unloading and storage. These provisions do not however relieve the subcontractors from the responsibility of coordinating all work with the other sub trades.

The written categorization of work into various sections or divisions does not release the Prime Contractor(s) from the responsibility of performing the work assigned to him. Prime Contractor(s) shall read all parts of the Project Manual.

The Prime Contractors of each perspective base bid shall confer with one another and coordinate work to provide no interference with work.

36. **CO-ORDINATION OF THE WORK:**
Each Prime Contractor shall co-ordinate with all work in progress on the site and shall co-ordinate the storage of materials; shall keep himself informed of the progress and detailed work of all the contractors and shall work with the Architect in the co-ordination and expediting of all work so that the progress of the work shall be kept on schedule.

Each contractor shall confer and co-operate with all other contractors whose work occurs in the same area. If this contractor installs any of this work without such cooperation, and in doing so interferes with or prevents the installation of other work in the area, he shall bear the responsibility to remove as required his work so that the other work can be completed.

37. **BASE BID:**
Base Bids will be received utilizing the method of bidding as follows: Single Base Bid for ALL of the work.

38. **ALTERNATE BIDS:**
Bidder shall carefully read requests for Alternate Bids and thoroughly examine the drawings and specifications to determine the extent the various changes and conditions will affect the Bid.

Space(s) are provided in the Bid Form for requested Alternate Bids. Failure to submit a bid for any
requested Alternate Bid shall result in rejection of the entire bid.

Bidder shall state the amount to be added to or deducted from the Base Bid for making the changes, including all incidentals, omissions, additions and adjustments as may be necessary or required by such changes. If there is no difference in price, Bidder shall insert the words "No Change".

39. **HAZARDOUS SUBSTANCES - ASBESTOS**
Airborne asbestos fibers and similar dust, if encountered, have been determined to be hazardous to one's health.

Contractors attention is directed to the Occupational Safety and Health Act (OSHA) in general and to Part 1910.1001 - ASBESTOS in particular. This has been incorporated into Wisconsin Administrative (Building) Code and identified as Ind. 1910.93a; compliance with all possible applicable provisions is the Contractors responsibility.

It is assumed that there is no asbestos work or contact with asbestos as part of the work in this project.

If contractor does suspect or encounter asbestos he shall stop work in area and notify OWNER as soon as possible.

40. **UNIT COSTS OR PRICES:**
Unit prices requested on the Bid Form shall be given and, if included in the contract, will be used for additions to or deductions from amount of work required under the contract. Unit prices shall include all costs of materials, labor, insurance, overhead and profit.

The OWNER reserves the right to reject any unit prices as given in the Bid if they are considered excessive or unreasonable, or to accept any or all of such unit prices that may be considered fair and reasonable. If any unit price is rejected for reasons stated herein, the work governed by such unit price, if required, shall be treated as specified in General Conditions, Article 7, entitled "Changes in the Work".

The Bidder shall refer to the Bid Form and the applicable technical section to determine the basis of unit measure and the detailed information related to each unit price item.

41. **SALVAGE ITEMS:** Unless noted on the drawings and specifications, all demolished items removed from the building are the contractors and is to be properly disposed of off the site.

42. **JOB SUPERINTENDENT:** After contracts have been signed, within ten (10) days, the contractor shall forward name(s) of job superintendent to be employed on this project to the OWNER for approval. If job superintendent is not approved, contractor shall furnish names of other job superintendents to OWNER for approval.
43. **EXISTING OCCUPANTS:** The prime contractors shall execute great care in maintaining safe access to and from the building and cause as little disturbance to the occupants as possible during the construction period. The passage within building shall be maintained clear of obstructions at all times. Before any work beings, install fencing on site at work area.

**GRADUATION DATE: MAY 26, 2017:** Contractor shall MAKE SURE that the sire is clean and clear on this date as the high school will be hosting about 1500 people for graduation and they will be entering the High School by the entry immediately adjacent to the addition project.

44. **AMERICAN MADE EQUIPMENT & PRODUCTS:**
Bidders are encouraged, to the greatest practicable, to purchase American Made Equipment and Products.

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SECTION 01 04 00
PROJECT COORDINATION

THIS SECTION specifies requirements for project coordination including:

Co-ordination.
Administrative and Supervisory personnel.
General installation provisions.
Cleaning and protection.

COORDINATION:
Coordinate activities included in various Sections to assure efficient and orderly installation of each component. Coordinate operations included under different Sections that are dependent on each other for proper installation and operation.

Where installation of one component depends on installation of other components before or after its own installation, schedule activities in the sequence required to obtain the best results.

Where space is limited, coordinate installation of different components to assure maximum accessibility for maintenance, service and repair.

Make provisions to accommodate items scheduled for later installation.

Prepare memoranda for distribution to each party involved outlining required coordination procedures. Include required notices, reports, and attendance at meetings.

Prepare similar memoranda for the Owner and separate Contractors where coordination of their work is required.

SPACE PREFERENCE FOR MECHANICAL AND ELECTRICAL EQUIPMENT:
Each trade shall carefully check and coordinate the location and level of all service lines. Run preliminary levels and check with all other trades so that conflict in location may be avoided.

If conflicts occur, the following preference schedule shall be followed:

Recessed electrical fixtures
Sanitary and storm drainage
Hot and chilled water lines
Low pressure ductwork
Domestic water supply lines
Sanitary and storm vent lines
Electrical conduits

No other work shall have preference over plumbing lines directly below fixtures.
No other work shall have preference over bus duct or conduit above or below electrical switchgear and panels.

No piping conveying fluids shall be installed directly over electrical equipment.

**ADMINISTRATIVE PROCEDURES:**
Coordinate scheduling and timing of administrative procedures with other activities to avoid conflicts and ensure orderly progress. Such activities include:

- Preparation of schedules.
- Installation and removal of temporary facilities.
- Delivery and processing of submittals.
- Progress meetings.
- Project closeout activities.

**STAFF NAMES:**
Within fifteen (15) days of Notice to Proceed, submit a list of Contractor's staff assignments, including Superintendent and personnel at the site; identify individuals, their duties and responsibilities.

**INSPECTION OF CONDITIONS:**
The Installer of each component shall inspect the substrate and conditions under which Work is performed. Do not proceed until unsatisfactory conditions have been corrected.

**MANUFACTURER'S INSTRUCTIONS:**
Comply with manufacturer's installation instructions and recommendations, to the extent that they are more stringent than requirements in Contract Documents.

INSPECT material immediately upon delivery and again prior to installation. Reject damaged and defective items.

Recheck measurements and dimensions before starting installation.

Install each component during weather conditions and project status that will ensure the best results. Isolate each part from incompatible material as necessary to prevent deterioration.

Coordinate temporary enclosures with inspections and tests, to minimize uncovering completed construction for that purpose.

**MOUNTING HEIGHTS:**
Where mounting heights are not indicated, install components at standard heights for the application indicated. Refer questionable decisions to the Architect.

**CLEANING AND PROTECTION:**
During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

Clean and maintain completed construction as often as necessary through the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

LIMITING EXPOSURES:
Supervise operations to ensure that no part of construction, completed or in progress, is subject to harmful or deleterious exposure. Such exposures include:

- Excessive static or dynamic loading.
  - Excessive internal or external pressures.
  - Excessive weathering.
  - Excessively high or low temperatures or humidity.
  - Water or ice.
  - Chemicals or solvents.
  - Heavy traffic, soiling, staining and corrosion.
  - Unusual wear or other misuse.
  - Contact between incompatible materials.
  - Theft or vandalism.

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SECTION 01 50 00
TEMPORARY FACILITIES

WORK INCLUDED: See Division 1-N - Special Conditions for articles regarding Temporary Facilities as part of this Section.

SUMMARY:
This Section specifies temporary services and facilities, including utilities, construction and support facilities, security and protection. Provide facilities ready for use. Maintain, expand and modify as needed. Remove when no longer needed, or replaced by permanent facilities.

USE CHARGES:
Cost or use charges for temporary facilities are not chargeable to the Owner or Architect, and will not be accepted as a basis of claims for a Change Order.

SUBMITTALS:
Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities. Submit a schedule showing implementation and termination of each temporary utility within fifteen (15) days of commencement of the Work.

REGULATIONS:
Comply with applicable laws and regulations.

ELECTRICAL SERVICE:
Comply with NEMA, NECA AND UL standards and regulations for temporary utility before use. Obtain required certifications and permits.

INSPECTIONS:
Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

CONDITIONS OF USE:
Keep facilities clean and neat. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload, or permit facilities to interfere with progress. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

MATERIALS AND EQUIPMENT:
Provide new materials and equipment; if acceptable to the Architect, undamaged previously used materials and equipment in serviceable condition may be used. Provide materials and equipment suitable for the use intended.

TEMPORARY UTILITY INSTALLATION:
Engage the local utility company to install temporary service or connect to existing service. Arrange for a time when service may be interrupted to make connections. Provide adequate capacity at each
stage of construction. Prior to temporary utility availability, provide trucked-in services.

BARRICADES, WARNING SIGNS AND LIGHTS:
Comply with standards and code requirements for erection of barricades. Paint appropriate warning signs to inform personnel and the public of the hazard being protected against. Where needed provide lighting, including flashing lights.

TERMINATION AND REMOVAL:
Remove each facility when the need has ended, or replaced by a permanent facility, or no later than Substantial Completion. Complete or restore construction delayed because of interference with the facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

Temporary facilities are property of the Contractor.

At Substantial Completion, renovate permanent facilities used during the construction period.

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SECTION 01 70 00
PROJECT CLOSEOUT

SUBSTANTIAL COMPLETION: Before requesting inspection for certification of Substantial Completion, complete the following:

In the Application for Payment that coincides with the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed substantially complete.

Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

Submit record drawings, maintenance manuals, damage or settlement survey, property survey, and similar record information.

Change-over permanent locks and transmit keys to the Owner.

Complete start-up testing of systems, and instruction of the Owner's personnel. Remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

Complete final clean up. Touch-up and repair and restore marred exposed finishes.

INSPECTION PROCEDURES:
On receipt of a request for inspection, the Architect will proceed 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.

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

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

FINAL ACCEPTANCE:
Before requesting inspection for certification of final acceptance and final payment, complete the following:

Submit final payment request with releases.

Submit a final statement, accounting for changes to the Contract Sum.

Submit a copy of the final inspection list stating that each item has been completed or otherwise resolved for acceptance.
Submit final meter readings for utilities, a record of stored fuel, and similar data as of Substantial Completion.

Submit consent of surety to final payment.

Submit evidence of continuing insurance coverage complying with insurance requirements.

**REINSPECTION PROCEDURE:**
The Architect will reinspect the Work upon receipt of notice that the Work has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.

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.

If necessary, reinspection will be repeated at contractors expense to cover Architects expenses.

**RECORD DOCUMENTS:**
Do not use Record Documents for construction purposes; protect from loss in a secure location; provide access to Record Documents for the Architect's reference.

**RECORD DRAWINGS:**
Each contractor shall maintain a record of all field changes made during the course of construction. At substantial completion of the project, the Architect will furnish the Contractor with two sets of prints for the purpose of making these changes. After the Contractor has marked all field changes, these prints shall be returned to the Architect. Record drawings shall be submitted before final payment is made to the Contractor.

**RECORD SPECIFICATIONS:**
Maintain two copies of the Project Manual, including addenda. Mark to show variations in actual Work performed in comparison with the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot be readily discerned later by direct observation. Note related record drawing information and Product Data.

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

**MAINTENANCE MANUALS:**
Organize maintenance data into sets of manageable size. Bind in individual heavy-duty two-inch, three-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark identification on front and spine of each binder. Include the information required in Technical Sections of these specifications.

**OPERATING AND MAINTENANCE INSTRUCTIONS:**
Arrange for the installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Include a detailed review of the following: See Technical Sections of these specifications.

As part of instruction for operating equipment, demonstrate the following procedures:

Start-up and shutdown.
  Emergency operations.
  Noise and vibration adjustments.
  Safety procedures.

**FINAL CLEANING:**

Employ experienced workers for final cleaning. Clean each surface to the condition expected in a commercial building cleaning and maintenance program. Complete the following before requesting inspection for certification of Substantial Completion:

Remove labels that are not permanent labels.

Clean transparent materials. Remove glazing compound. Replace chipped or broken glass.

Clean exposed hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

Clean the site of rubbish, litter and other foreign substances. Sweep paved areas; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

**REMOVAL OF PROTECTION:**

Remove temporary protection and facilities.

**COMPLIANCE:**

Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Remove waste materials from the site and dispose of in a lawful manner.
SECTION 02 07 00
SELECTIVE DEMOLITION

GENERAL: Applicable provisions of Division 1 shall govern work of this Section.

EXTENT of selective demolition work is indicated on drawings.

TYPES OF SELECTIVE DEMOLITION WORK:
Demolition requires the selective removal and subsequent offsite disposal of the following:

Portions of building structure indicated on drawings and as required to accommodate new
construction. Dotted or noted on drawings.

Removal of exterior walls as indicated on drawings.

Removal of doors and frames indicated "remove".

Removal and protection of existing fixtures and equipment items indicated "salvage".

RELATED WORK SPECIFIED ELSEWHERE:
Remodeling construction work and patching is included within the respective sections of
specifications, including removal of materials for re-use and incorporated into remodeling or
new construction.

Relocation of pipes, conduits, ducts, other mechanical and electrical work are specified by respective
trades.

SCHEDULE:
Submit schedule indicating proposed sequence of operations for selective demolition work to
Owner's Representative for review prior to commencement of work. Include coordination for
shut-off, capping, and continuation of utility services as required, together with
details for dust and noise control. Provide detailed sequence of demolition and removal work to
ensure uninterrupted progress of Owner's on-site operations.

OCCUPANCY:
Owner will be continuously occupying areas 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 which will impact Owner's normal operations.

CONDITION OF STRUCTURES:
Owner assumes no responsibility for actual condition of items or structures to be demolished.
Conditions existing at time of commencement of contract will be maintained by Owner insofar as
practicable. However, variations within structure may occur by Owner's removal and salvage
operations prior to start of selective demolition work.

**PARTIAL DEMOLITION AND REMOVAL:**

Items indicated to be removed but of salvable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed. Storage or sale of removed items on site will not be permitted.

**PROTECTIONS:**

Provide temporary barricades and other forms of protection as required to protect Owner's personnel and general public from injury due to selective demolition work. Provide protective measures as required to provide free and safe passage of Owner's personnel and general public to and from occupied portions of building.

Erect temporary covered passageways as required by authorities having jurisdiction. See Special Conditions, Division 1 for temporary enclosures.

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

Protect floors with suitable coverings when necessary.

Construct temporary insulated solid 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 if required.

Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces, and installation of new construction to insure that no water leakage or damage occurs to structure or interior areas of existing building.

Remove protections at completion of work.

**DAMAGES:**

Promptly repair damages caused to adjacent facilities by demolition work at no cost to Owner.

**TRAFFIC:**

Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

**UTILITY SERVICES:**

Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
ENVIRONMENTAL CONTROLS:
Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

INSPECTION:
Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions to structure surfaces, equipment or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Owner's Representative prior to starting work.

PREPARATION:
Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain. Cease operations and notify Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

Cover and protect furniture, equipment and fixtures to remain from soiling or damage when demolition work is performed in rooms or areas from which such items have not been removed.

Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building. Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust-proof partitions of minimum 3 1/2" studs, 5/8" drywall (joints taped) on occupied side, 1/2" fire-retardant plywood on demolition side, and fill partition cavity with sound-deadening insulation. Co-ordinate with Division 1-P, Article 14. Temporary Enclosures and Dust Barriers. Provide weatherproof closures for exterior openings resulting from demolition work.

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

Provide by-pass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner if shut-down of service is necessary during change-over.

DEMOLITION:
Perform selective demolition work in a systematic manner.
Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors or framing.

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

Demolish foundation walls to a depth of not less than 12" below existing ground surface or below new construction. Demolish and remove below-grade wood or metal construction.

Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel or sand, free of trash and debris, stones over 6" diameter, roots or other organic matter.

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

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

DISPOSAL OF DEMOLISHED MATERIALS:
Remove debris, rubbish and other materials resulting from demolition operations from building site. Transport and legally dispose of materials off site. 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. Burning of removed materials is not permitted on project site.

CLEAN UP AND REPAIR:
Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean. Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

*******
SECTION 02 20 00
EARTHWORK FOR BUILDINGS AND SITE IMPROVEMENTS

GENERAL
Applicable provisions of Division 1 shall govern work under this Section.

WORK INCLUDED
Excavating
Backfilling and Grading
Compaction
Pavement Subbase Course
   Spreading Topsoil

RELATED WORK:
All Sections in Division 2 - Site Work.
Section 03 31 00 - Concrete Work.
Section 07 19 00 - Vapor Brriers.
Division 1-R - Soil Report.
Existing Utilities: Locate by hand excavation and provide protection from damage. Cooperate with
   Owner and utility companies for maintaining services. Do not break utility connections
   without notifying Architect/Engineer a minimum of 48 hours in advance and providing
   acceptable temporary services. Repair damages to existing utilities as directed by utility
   company.

EXPLOSIVES
Use of explosives is not permitted.

PROTECTIONS
Protect structures, utilities, sidewalks, pavements, and other facilities in areas of work. Barricade
open excavations and provide warning lights. Comply with regulations of authorities having
jurisdiction.

OBSERVATION AND TESTING SERVICE
Contractor shall employ a testing laboratory to perform soil observation and testing service for
quality control testing during earthwork operations. Include in Base Bid a $25,000
allowance for General Contractor and $10,000 for Site Work Contractor for construction
testing. Dollars not used will be credited by Change Order.

Test Reports-Excavating: Submit following reports directly to Architect/Engineer from the testing
   services, with copy to Contractor:

Test reports on borrow material.
Verification of each footing subgrade.
Field density test reports.

Report of actual unconfined compressive strength, static cone tests, and/or results of bearing tests of each strata tested.

Quality Control Testing During Construction: Allow testing service to observe, test and approve subgrades and fill layers before further construction work is performed.

Footing Subgrade: For each strata of soil on which footings will be placed, conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Architect/Engineer.

Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 2000 sq. ft. of new paved area or building slab, but in no case less than 3 tests. In each compacted fill layer, make one field density test for every 2000 sq. ft. of overlaying building slab or paved area, but in no case less than 3 tests.

Foundation Wall Backfill: Take at least 2 field density tests, at locations and elevations as directed.

Special Note about failed test reports: The General Contractor shall pay for re-doing the soils compaction and all additional re-testing reports of soils to bring up to specified density. The Architect shall be the judge of acceptable testing service reports submitted by the General Contractor.

PROVIDE BRACING AND SHORING as required in excavations, to maintain sides and to protect adjacent structures from settlement, complying with local codes and regulations. Maintain until excavations are backfilled.

SATISFACTORY SOIL MATERIALS are defined as those complying with ASTM D 2487 soil classification groups GW, GP, GM, SM, GC, SC, CL, CH, SW, and SP if approved by the Geotechnical Engineer.

UNSATISFACTORY SOIL MATERIALS are defined as those complying with ASTM D 2487 soil classification groups ML, MH, OL, OH and PT if approved by the Geotechnical Engineer.

SUBBASE FILL MATERIAL: Naturally or artificially graded mixture of crushed gravel, crushed stone, or crushed slag free of vegetation, debris, or other objectionable materials.

EXCAVATION: Remove and dispose of material encountered to obtain required subgrade elevations, if rejected by the Geotechnical Engineer, including pavement, obstructions visible on ground surface, underground structures and utilities indicated to be removed.
ROCK REMOVAL: Material to be excavated is assumed to be earth and other materials that can be removed with hand tools or power shovel. If rock is encountered within the limits of the excavation, the Contractor shall immediately notify the Architect and shall not proceed further until written instructions are given and measurements taken for purposes of establishing volume of rock excavation. With his proposal, this contractor shall submit a unit price quotation indicating the cost per cubic yard for "rock" excavation should same be encountered in the execution of the excavating work. Price per cubic yard for rock removal shall include hauling. Maximum bottom clearance from below all concrete slabs, floors, footings, pipes, or other structures for payment shall be 8". Maximum side clearance for payment shall be 16" unless otherwise shown on plan. If "rock" is encountered within the limits of the excavation, the contractor shall immediately notify the Architect and shall not proceed further until written instructions are given and measurements taken for purposes of establishing volume of "rock" excavation. Whenever the work "rock" is used in these specifications, it shall mean any material that cannot be removed with a modern power shovel, having adequate power and being in good running condition in the hands of an experienced operator, equivalent to a John Deere 690 backhoe using a ripper tooth, Bucyrus-Erie #20H Series 4, or Cat #266. Any material that can be removed with specified equipment will not be considered "rock" and contractor shall not be paid an extra. The Architect shall be the sole judge as to what constitutes "rock" excavation.

UNAUTHORIZED EXCAVATION (removal of materials beyond indicated subgrade elevations) may be filled with lean concrete, or corrected by extending indicated bottom elevation of footing to lower elevation, as acceptable to Architect/Engineer or engineered compacted fill to 95% ASTM D-1557 density.

STOCKPILE excavated materials where directed, until required for backfill and fill. Any extra soil not needed on this project shall be hauled off site.

EXCAVATE FOR STRUCTURE to elevations and dimensions shown, extending excavation a sufficient distance to permit placing and removal of other work and for inspection. Trim bottom to required lines and grades to provide solid base to receive concrete. Maintain in place adequate structures, barricades, guards, warning lights, other protection as required at excavation and hazards created by this work. Due care and diligence shall be exercised in all digging and backfilling operations. Protect both overhead and underground utilities that are to remain, including materials and property from damage. Bear responsibility for and replacement costs of all damage arising from all operations connected with this work. Maintain carefully all benchmarks, monuments and other reference points, if disturbed or destroyed, replace as directed. Maintain all pits and trenches free of water at all times. Provide all pumping required to keep excavated spaces clear of water.

EXCAVATE FOR TRENCHES (excavations and backfill required for mechanical trades to be performed by contractors requiring such work. See mechanical specifications) to depth indicated or required and to establish indicated flow lines or invert elevations. Maintain uniform width required for particular item to be installed, including width to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit. Outside building, excavate trenches for water bearing piping so top of piping is not less than 7'-0" below finished grade.
CUT GROUND UNDER PAVEMENTS AMD BUILDING AREAS to comply with cross-sections, elevations, and grades indicated. Proof roll exposed subgrade.

IF UNSATISFACTORY SOIL MATERIALS are encountered at design elevations, continue excavation as directed by Architect/Engineer. If conditions are not a result of Contractor's negligence, additional excavation will be measured as directed by Architect/Engineer and paid for in accordance with contract conditions relative to changes in work.

BACKFILL AND FILL: Place and compact acceptable soil material in 9" maximum loose layers to required elevations. Use soil material free of rock or gravel larger than 2" in any dimension, debris, vegetable matter, waste, and frozen materials. Use subbase material where indicated under piping or conduit; shape to fit bottom 90 deg of cylinder.

Backfill excavations as promptly as work permits.

Prepare ground surface to receive fill by removing vegetation, debris, unsatisfactory soil materials and obstructions. Scarify as required so that fill material will bond with existing surface.

Place backfill and fill materials in layers not more than 8" in loose depth, compacting each layer to required maximum density. Do not place materials on surfaces that are muddy, frozen, or contain ice or frost.

Fill 6" below the floor slab shall consists of 3/4" base course crushed Limestone gravel over 2" sand cushion over vapor barrier.

Subgrade fill may consist of granular material containing up to 15% passing #200 sieve.

Backfill against retaining and pit walls shall be GW or GP.

COMPACITION

General: Control soil compaction during construction providing minimum percentage of density specified for each area classification as indicated below. See Soils Report in Division 1 for foundation and site preparation.

Percentage of maximum density requirements: Compact soil to not less than the following percentages of maximum density determined in accordance with ASTM D 1557 Modified Proctor Dry Density.

Structures, building slabs, pavements: Compact each 9" layer of backfill or fill material at 95% of ASTM D-1557 Density, at floor slab and fill used under footings. The gravel base course under footings and slabs on grade to be compacted to 95%.

Walkways: Compact final 12" layer of backfill or fill material at 95% of ASTM D-1557.
Lawns or unpaved areas; Compact to 90% Modified Proctor Dry Density.

Sprinkle water on surface of subgrade or layers of soil material where soil is too dry to permit compaction to required density. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to required density.

GRADING
Grade areas indicated, including adjacent transition areas, with uniform levels or slopes between finish elevations. Shape surface of areas to within 0.10' above or below required subgrade elevation, compacted as required.

FINISH GRADING
Site Work Contractor is to spread the existing stockpiled topsoil to 6" thickness. If site stockpiled topsoil is insufficient to provide 6" cover over new grass areas, Site Work Contractor shall import to site topsoil.

MAINTENANCE
Repair and re-establish grades in settled, eroded, rutted, or otherwise damaged areas. In damaged compacted areas, scarify surface, re-shape, and compact to required density prior to further construction.

DISPOSAL
Remove excess excavated material, trash, debris, and waste material from site.

* * * * *
SECTION 02 52 00
CONCRETE SIDEWALKS

GENERAL
Applicable provisions of Division 1 shall govern work of this Section.

WORK INCLUDED
Concrete sidewalks.

RELATED WORK
All Sections in Division 2 - Site Work.
Section 03310 - Concrete Work.

DESCRIPTION OF WORK
Extent of Portland cement concrete work is shown on drawings, including walks.
Prepared subbase is specified in "Earthwork" section.
Concrete and related materials are specified in Division 3.

SUBMITTALS
Furnish samples, manufacturer's product data, test reports, and materials' certifications as required in referenced sections for concrete.

MATERIALS
Forms: Steel, wood, or other suitable material or size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.
Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.

CONCRETE MIX, DESIGN AND TESTING
Comply with requirements of applicable Division 3 sections for sampling and testing, and quality control, and as herein specified.
Design mix to produce normal-weight concrete consisting of portland cement, aggregate, air-entraining admixture and water to produce the following properties:
Compressive Strength: 4000 psi, 6 bag mix minimum.
Slump range: 5" maximum.
Air content: 5% minimum entrained air.
SURFACE PREPARATION
Remove loose material from compacted subbase surface immediately before placing concrete.

FORM CONSTRUCTION
Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

Check completed formwork for grade and alignment to following tolerances:

Top of forms not more than 1/8” in 10’.
Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

CONCRETE PLACEMENT
General: Comply with requirements of Division 3 sections for mixing and placing concrete, and as herein specified.

Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

Deposit and spread concrete in a continuous operation. If interrupted for more than 1/2-hour, place an expansion joint.

JOINTS
Tooled joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer, space 6'-0" o.c. unless noted otherwise. Saw cut joints not acceptable.

Expansion joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.

Locate expansion joints at 30’ o.c. unless otherwise indicated.

Extend joint fillers full-width and depth of joint.

Furnish 1/2" asphaltic joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.

CONCRETE FINISHING
After consolidating concrete and striking-off, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

Broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Architect.

On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic.

CURING
Protect and cure finished concrete work complying with applicable requirements of Division 3 sections. Use curing and sealing compound or approved moist-curing methods.

REPAIRS AND PROTECTIONS
Repair or replace broken or defective concrete, as directed by Architect.

Protect concrete from damage until acceptance of work.

* * * * *
SECTION 03 31 00
CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

RELATED DOCUMENTS:
Applicable provisions of Division 1 shall govern work of this Section.

WORK INCLUDED:
Cast-in-Place Concrete.
Concrete Formwork.
Concrete Floor Sealer.
Concrete Reinforcement.
Concrete Tests.

RELATED WORK:
Section 04 20 00 – Unit Masonry.
Section 05 12 00 – Structural Steel.
Section 05 50 00 – Metal Fabrications.
Section 07 60 00 - Flashing and Sheet Metal

REFERENCES
Comply with the recommended practices and procedures of the following standards and with modifications as specified herein.

ACI – American Concrete Institute:
  ACI 301 Specifications for Structural Concrete for Buildings.
  ACI 302 Guide for Concrete Slab and Floor Construction.
  ACI 306 Cold Weather Concreting.
  ACI 117 Standard Tolerances for Concrete Construction and Materials.
  ACI 318 Building Code Requirements for Reinforced Concrete.
  ACI 360 Guide to Design of Slab-on-Ground.

ASTM International – American Society for Testing and Materials:
  ASTM E 1643-98 Installation of Water Vapor Retarders.

CRSI – Concrete Reinforcing Steel Institute:
SUBMITTALS

Product Data: For reinforcement, steel and synthetic fiber reinforcement, forming accessories, admixtures, patching compounds, waterstops, vapor barrier, vapor retarder, joint systems, curing compounds, floor sealers, floor coatings, foam insulation and others as requested by Architect.

Shop Drawings: For fabricating, bending, and placing concrete reinforcement and supports; type, size and location of all accessories (bar schedules, stirrup spacing, and diagrams of bent bars, arrangements & accessories), bar laps on strings of horizontal bars (all lap splices shall develop full strength of bar unless lesser laps permitted by drawings), manufacturers specifications and installation instructions for splice devices. Comply with ACI 318 Manual of Standard Practice for Detailing Reinforced Concrete Structures.

Laboratory Test Reports: For concrete materials. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

Concrete Mix Designs: Two copies of proposed concrete mix designs at least 15 days prior to start of concreting. Do not begin concrete production until mixes have been reviewed by Architect.

Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

QUALITY ASSURANCE:

Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

- ACI 301 "Specifications for Structural Concrete for Buildings"
- ACI 318 "Building Code Requirements for Reinforced Concrete"
- Concrete Reinforcing Steel Institute, "Manual of Standard Practice"

Concrete testing service: Contractor shall employ a testing laboratory to perform concrete tests at no cost to Owner.

PART 2 - PRODUCTS

CONCRETE FORMWORK

Forms for unexposed finish concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit. Split, frayed, delaminated or damaged form materials will not be acceptable for use.

Provisions for other trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such
items. Accurately place and securely support items built into forms.

Forms for exposed finish concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form", Class I.

Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edgesealed, with each piece bearing legible inspection trademark.

Form coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces. Acceptable product is "Crete-Lease 880" Release Agent as manufactured by Creset Chemical Company, Weston, Ohio, 1-800-367-2020.

Form ties - removable or snap off metal form ties to prevent spalling upon removal. To keep forms straight, true and free from buckling.

Form removal: Forms must stay in place three days minimum except in cold weather, seven day minimum. Forms can be removed sooner if care is taken to prevent excessive rapid moisture loss.

**CONCRETE REINFORCEMENT MATERIALS**

Reinforcing Bars: Comply with ASTM A615, Grade 60.

**SYNTHETIC FIBER REINFORCEMENT**

Synthetic Fiber Reinforcement: Synthetic fibers engineered and designed for use in slab on grade, steel pan stair slabs, housekeeping pads and precast topping slabs, complying with ASTM C-1116; 4.1.3, Type III.

Micro-Synthetic Fiber Reinforcement: Fine micro monofilament or fibrillated synthetic fibers (diameters less than 0.012inches) added to concrete to reinforce concrete against plastic shrinkage. Dosage rate shall be in the range of 0.75 to 3.0 lb/cu yd. Refer to drawings for the dosage required. Approved products include the following:

- Fibermesh 300 fibers, Propex Concrete Systems.
- Matrix Monofilament Fibers, FRC Industries.
- Polymesh Mirco-Fiber, General Resource Technology.
- Fiberstand 100, The Euclid Chemical Company.
Approved Equal.

Macro-Synthetic Fiber Reinforcement: Macro monofilament fibers (diameters greater than 0.012 inches) added to concrete to increase post crack residual strength. Dosage rate shall be in the range of 3.0 to 15.0 lbs/ cu yd. Refer to drawings for the dosage required. Approved products include the following:

- Forta Ferro, Forta Inc.
- Strux 90/40, W.R. Grace Company.
- Matrix HPS, FRC Industries.
- Advantage Structural Fiber, General Resource Technology.
- Tuf-Strand SF, The Euclid Chemical Company.

Approved Equal.

Macro-Synthetic Blended Fiber Reinforcement: A blend of polypropylene/polyethylene macro monofilament fibers and polypropylene micro monofilament fibers added to concrete to reduce plastic shrinkage cracks and increase post crack residual strength. Dosage rate shall be in the range of 5.0 to 15.0 lbs/ cu yd. Refer to drawings for the dosage rate required. Approved products include the following:

- Novomesh 950, Propex Concrete Systems.
- Matrix HPS 950, FRC Industries.

Approved Equal.

CONCRETE MATERIALS

Portland Cement - ASTM C150, Type I.


Aggregate (Fine) - sand for concrete shall be well graded, clean, sharp, coarse, washed sand, free from loam clay or organic materials. Conform to ASTM C-33.

Aggregate (Coarse): Conform to ASTM C-33.

Water: Clean, potable, free from strong acids, alkalis, oil or organic matter.

MIX PROPORTIONS AND DESIGN

Proportion mixes complying with mix design procedures specified in ACI 301.

Submit written report to Architect for each proposed concrete mix at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed and are acceptable to
Architect. Approval of mix design does not relieve the Contractor of the responsibility to provide the concrete strengths specified.

Ready Mix Concrete: Shall be measured, mixed and delivered in accordance with ASTM C 94.

Mix Design Schedule:

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<th>Class</th>
<th>Name</th>
<th>Min Strength (psi)</th>
<th>Max Agg (inches)</th>
<th>Max Slump (inches)</th>
<th>Min Cement (lbs/cu yd)</th>
<th>Max Water/Cement Ratio</th>
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<td>Footings</td>
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<td>Bond Beams</td>
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Notes:
Minimum cement contents listed in schedule are based on use of water reducing agents specified.

Mixes without water reducing agents shall require a twelve percent increase in cement content.

Adjust mix designs when material characteristics, job conditions, weather, test results, or other circumstances warrant.

Comply with design drawings for design strength of each type and class of concrete.

Provide Air Entrained Admixture for all concrete exposed to freezing and thawing, having an air content percent with a tolerance of plus or minus 1-1/2 percent within the following limits: Concrete structures and slabs having a maximum aggregate size of 1-1/2 inches, 4.5 percent (moderate exposure) or 6.0 percent (severe exposure). Concrete structures and slabs having a maximum aggregate size of 3/4 inch, 5.0 percent (moderate exposure) or 6.0 percent (severe exposure).

Super Plasticizer Admixture may be used for all concrete at Contractors option.

Add fibrous concrete reinforcement to concrete materials at the time concrete is batched, in amounts in accordance with approved submittals for each type of concrete required.

Slump tolerance: 3 and 4 inch slump plus 1 inch minus 1/2 inch, 5 inch slump plus or minus 1-1/2 inch. Concrete containing high-range water reducing admixture (superplasticizer), 8
inch slump plus or minus 1 ½ inch.

Slump test shall be taken prior to the addition of high range water reducing agent and placement of concrete.

Ready – Mix Concrete: Shall be measured, mixed and delivered in accordance with ASTM C 94.

**ADМИКСТУРЫ**

Use water-reducing, accelerating, and retarding admixtures that have been tested and accepted in mix designs in strict compliance with manufacturer's directions.

Admixtures are limited to the following, unless approved by Architect. Provide admixtures that contain less than 0.1 chloride ions.

- **Air-Entraining Admixture:** ASTM C 260. Added only to normal Portland cement concrete to meet requirements specified for air content.
  - "Catexol A.E. 260" by Axim Concrete Technologies.
  - "Air Mix" by The Euclid Chemical Company.
  - "MB-VR" or "Micro Air" by Master Builders.
  - "Sika AER" by the Sika Chemical Company.
  - "Darex II AEA" by W.R. Grace & Co.
  - "Polychem AE or VR" by GRT Admixtures.

- **Water-Reducing Admixture:** Comply with ASTM C 494/C494M. Type A.
  - "Catexol 100N" by Axim Concrete Technologies.
  - "Eucon WR-75" by The Euclid Chemical Company.
  - "Pozzolith" 122N or 344N by Master Builders.
  - "Plastocrete" by Sika Chemical Company.
  - "WRDA with Hycol" by W.R. Grace & Co.
  - "Polychem 400 NC" by GRT Admixtures.

- **Water-Reducing, Retarding Admixture:** Comply with ASTM C 494/C494M Type D, when high temperatures, placing, or humidity conditions dictate.
  - "Catexol 1000R" by Axim Concrete Technologies.
  - "Eucon Retarder-75" by The Euclid Chemical Company.
  - "Pozzolith 100-XR" by Master Builders.
  - "Plastiment" by Sika Chemical Company.
  - "Daratard HC" by W.R. Grace & Co.
  - "Polychem R" by GRT Admixtures.

- **Water-Reducing, Accelerating Admixture:** ASTM C 494/C494M Type E.
  - "Catexol 2000 R.H.E" by Axim Concrete Technologies.
"Accelguard 80" by The Euclid Chemical Company.
"Dara Set Accelerator" by W.R. Grace & Co.
"Pozzutec 20" by Master Builders, Incorporated.
"Daraccel" by W.R. Grace & Company.
"Super Set" by GRT Admixtures.

High-Range Water-Reducing and Retarding Admixture (Superplasticizer): Comply with ASTM C 494/C494M Type F or G.
"Catexol 100 SP-MN" by Axim Concrete Technologies.
"Eucon 37" by The Euclid Chemical Co.
"Pozzolith" 400N by Master Builders
"Sikament" by Sika Chemical Co.
"ADVA 100 or Daracem-100" by W.R. Grace & Co.
"Polychem SPC or Melchem" by GRT Admixtures.

ACCESSORIES

Bond breakers: Install compressible bituminous filler conforming to ASTM D 1751. Size ¼" thick x slab thickness. Provide where concrete floor slab abuts any vertical surface.

Control joints in slab on grade: Provide to form panels or patterns as shown. Use 1/8" x 1/4" premolded hardboard or fiber board strip inserted into the fresh concrete until the top surface of the strip is flush with the slab surface. After concrete has cured for at least seven days, remove inserts and clean loose debris from the grooves. Contractor may in lieu of the above provide 1/8" x 1 1/4" sawcut. Joint to be sawn within 4 to 12 hours after slab is poured. Fill in groove with joint sealant.

Moisture barrier: ASTM D 1709, ASTM D 882, ASTM E 1745, Class A, Yellow 15-mil thick polyethylene, permeance of less than 0.01 perms per ASTM F 1249 or ASTM E 96. Maintain permeance of less than 0.01 perms after mandatory conditional tests per ‘ASTM E 154, Sections 8, 11, 12 and 13. Furnish products as manufactured by one of the following:

“Stego Wrap 15-mil Vapor Barrier” by Stego Industries.
“Vaporguard 15-mil” by Reef Industries.
“Reflex Super” by Monarflex.
“Viper Vaporcheck II” by Insulation Solutions Inc.
“Perminator 15 mil” by W.R. Meadows.
“Barrier-Bac, IntePlus XL Film VB-350 (16 mil)” by Inteplast Group.
 Poly-America’s “Husky Yellow Guard” 15 Mill Vapor Barrier

Water stops: Shall be expansive clay waterproofing type. Furnish water stops manufactured by one of the following or approved equal:

“Swellstop” by the Greenstreak Company.
Progress Unlimited, Inc.
Westec Barrier Technologies, Division of Western Textile Products, Inc.
Williams Products, Inc.

HARDENED CONCRETE FLOOR SEALER:

Provide a water clear, chemically neutral, liquid applied curing compound and membrane sealer to serve as a chemical weather resistant sealer and dustproofing agent. Shall be applied to all exposed concrete floors where noted on Room Finish Schedule as "exposed concrete".

Applications - First coat shall be applied immediately after final trowelling of concrete. 200-500 square feet per gallon depending upon the concrete surface porosity. Second coat - apply after three days curing at the rate of 400 square feet per gallon. All in accordance with manufacturers recommendations. Furnish floor sealer manufactured by one of the following or approved equal:

"Kure-N-Seal W" by Sonneborn Building Products Division.
"Super Aqua-Cure VOX" by Euclid Chemical Company.
"Masterkure” by Master Builders Technologies.

PART 3 – EXECUTION

CONCRETE PLACEMENT:

Preplacement inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.

Comply with hot and cold weather concreting: ACI Code and PCA Publications. Design mixes shall be submitted for approval to the Architect. In cold weather comply with ACI 306.

Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

Do not use vibrators to transport concrete inside forms.

Placing concrete slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners, free of voids and Honeycomb.

Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

Maintain reinforcing in proper position during concrete placement operations.

Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

All floors with drains shall be pitched to drain rapidly. Floors that do not drain shall be removed, regraded and repaired all at the expense of the General Contractor.

General Contractor: See mechanical drawings - schedules - for required concrete pads under equipment required and installed by General Contractor. Concrete pads shall have 6x6 - W1.4x W1.4 welded wire fabric reinforcement.

CONCRETE FINISH SURFACES

Finish surfaces that will be exposed to view, painted, or covered with a floor finish material, shall be steel trowelled smooth. Floors to be level with a tolerance of 1/8” in ten feet except where drains occur.

Exterior finish for platforms, steps and sidewalks to be wood-float broom finish.

Curing: Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Continue curing by use of moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until forms are removed. Provide protections as required to prevent damage to exposed concrete surfaces.

REMOVAL OF FORMS:

Formwork not supporting weight of concrete such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F. (10 degrees C.) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

Formwork supporting weight of concrete such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum strength of in place concrete by testing field-cured specimens representative of concrete location or members.
Form facing material may be removed four days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

FIELD QUALITY CONTROL

Field Quality Control: The General Contractor shall retain a testing agency to perform testing and inspection by qualified parties as specified herein.

General: Structural Testing and Special Inspection services herein include items required by the 2009 IBC and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure. This testing does not relieve Contractor of responsibility of providing concrete in compliance with specifications. Contractor may perform additional testing as necessary to insure quality of concrete.

Definitions: Special Inspectors.

Technical I: ACI Certified Grade I Inspector. Inspector shall be employed by a testing laboratory, under the direct supervision of a Technical III.
Technical II: ACI Certified Grade II inspector. Inspector shall be employed by a testing laboratory, under the direct supervision of a Technical III.
Technical III: A civil / structural engineer regularly engaged in this type of work, with a minimum of 4 years experience and licensed in the State in which the Project is located. The licensed engineer shall review and approve all reports. Testing laboratory shall have C.C.R.L. certification at the National Bureau of Standards.
Structural I: Graduate civil/structural engineer with experience in the design of structural systems of this type. Inspector shall be under the direct supervision of a Structural II.
Structural II: Civil/structural engineer regularly engaged in the design of structural systems of this type, licensed in the State in which the Project is located. The licensed engineer shall review and approve all reports.

Special Inspection Exceptions: Special inspection, only, of cast-in-place concrete is not required for the following:

- Nonstructural slab-on-grade concrete.
- Concrete driveways and sidewalks on grade.

Structural Testing and Special Inspection Requirements:

Sampling Fresh Concrete: Sample and test all cast-in-place concrete; performed by Technical I.
Slump: ASTM C 143, one test at point of discharge for each load of each type of concrete. Conduct test prior to the addition in the field of any super-plasticizer. If a slump test fails, immediately retest same batch. If second test fails, concrete is rejected. Conduct additional tests when concrete consistency seems to have changed.

Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete. If air content test fails, immediately retest same batch. If second test fails, concrete is rejected.

Concrete Temperature: ASTM C 1064, one test hourly when air temperature is 40 deg. F (4 deg. C) and below, when 80 deg. F (27 deg. C) and above, and one test for each set of compressive-strength specimens.

Compression Test Specimen: ASTM C 31, one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store three (3) cylinders for laboratory-cured test specimens and one (1) for field-cured test specimen.

Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one field cured specimen retained in reserve for later testing if required.

On a periodic basis, perform concrete mix verification; performed by Technical I.

Verify mixer truck trip ticket conforms to approved mix design.
Verify that total water added to mix on site does not exceed that allowed by concrete mix design.
Verify that concrete quality is indicative of adequate mixing time, consistency, and relevant time limits.

On a continuous basis, inspect preparation and placement of all concrete; performed by Structural I.

Verify acceptable general condition of concrete base prior to placement.
Verify concrete has been sampled for required concrete tests.
Verify that concrete conveyance and depositing avoids segregation and contamination.
Verify that concrete is properly consolidated.
Verify reinforcement remains in proper location.

On a periodic basis, observe protection and curing methods for all concrete requiring inspections as indicated above; performed by Structural I.

Verify specified curing procedures are followed.
Verify that specified hot and cold weather procedures are followed.
On a continuous basis, inspect all bolts installed in concrete prior to and during concrete placement; performed by Structural I.

Verify specified size, type, spacing, configuration, embedment, and quantity.
Verify proper concrete placement and means have been taken to achieve consolidation around all bolts.

Strength Test Approval:

Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
When strength of field cured cylinders is less than 85 percent of companion laboratory cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in place concrete.

Additional Tests:

The testing agency will make additional tests of in place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.
Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

Measure floor and slab flatness and levelness according to ASTM E 1155/ASTM E 1155M within 48 hours of finishing.

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SECTION 03 41 00
PRECAST CONCRETE

PART 1 – GENERAL

RELATED DOCUMENTS:
Applicable provisions of Division 1 shall govern work of this Section.

WORK INCLUDED:
- Precast Concrete Hollow Core Plank.
- Precast Concrete Lintels.
- Connection plates with brackets and hangers.
- Grouting plank joint keys.

RELATED WORK:
- Section 03 30 00 - Cast-in-Place Concrete.
- Section 04 20 00 _ Unit Masonry.
- Section 05 12 00 – Structural Steel.

REFERENCE SPECIFICATIONS:
Comply with recommended practices and procedures of Prestressed Concrete Institute (PCI) MNL-116 and MNL-117, and as herein specified.

SUBMITTALS:
In addition to manufacturer's data and instructions, submit the following:
- Product Data: Indicate standard component configuration, design loads, allowable loads, deflections, and cambers.
- Shop Drawings: showing layout, dimensions, and identification of precast units, connection details, edge conditions, bearing requirements, support conditions, details of inserts, connections, joints, openings intended to be field cut, and relationship to adjacent materials. Indicate special reinforcement and lifting devices necessary for handling and erection. Submit structural calculations signed and sealed by a Wisconsin Structural Engineer.
- Precast concrete component supplier shall submit component drawings (six sets), stamped by a licensed Wisconsin Engineer three sets of calculations, Wisconsin Department of Safety & Professional Services (DSPS) submittal form with name of engineer and fees required for DSPS review and approval to Architects office.
- Fire-resistance rated precast units: Provide a certificate from the precast unit manufacturer certifying that the units used over the rooms calling for fire rated enclosure were tested and listed to meet Wisconsin Administrative Code requirements for the minimum fire rating called for on the plans.
QUALITY ASSURANCE:

Fire-resistance Rated Precast Units: Where precast concrete units are shown or scheduled as requiring fire-resistance classification, provide units whose fire resistance has been calculated according to PCI MNL-124-Design for Fire Resistance of Precast Prestressed Concrete.
Welding: Qualify procedures and personnel according to AWS D1.1 and AWS D1.4.
Connections: Design connections in accordance with PCI MNL-123-Manual on Design of Connections for Precast Pre-stressed Concrete.

Quality Control Standards: Manufacturing and testing procedures shall be in conformance with PCI MNL-116.

Dimensional Tolerances: Conform to PCI MNL-116, except that camber deviation from design camber shall plus or minus ¼ inch per 10 feet, but no greater than plus or minus 1/2-inch.

DELIVERY, STORAGE AND HANDLING:
Deliver precast units to project site in such quantities and at such times to assure continuity of installation. Store units to prevent cracking, warping, staining or other damage. Lift and support precast units only at designated lifting or supporting points. If precast is installed during months of snowfall, cover core ends to protect from blowing snow.

Provide formed openings in precast units and required headers for holes larger than 10" diameter or 10" square.

PART 2 - PRODUCTS

MANUFACTURERS
Precast Concrete Hollow Core Planks:
Any manufacturer with PCI Plant Certification.

CONCRETE MATERIALS:
Portland Cement: ASTM C 150, Type 1.
Aggregates: ASTM C 33, except local aggregates of proven durability may be used when acceptable to Architect.
Water: Potable.
Non-Shrink Grout: Non-metallic, minimum compressive strength of 10,000 psi at 28 days.
Cement Grout: Minimum compressive strength of 3,000 psi at 28 days.

REINFORCING MATERIALS:

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Reinforcing Bars: ASTM A 615, Grade 60.

Steel Wire: ASTM A 82.

Prestressing Tendons: ASTM A 416, uncoated, 7-wire stress-relieved strand, Grade 270 or Grade 250 unless otherwise indicated.

STEEL INSERTS AND CONNECTIONS:
ASTM A 36, galvanized after fabrication where exposed to weather.

FABRICATION:
Fabricate precast concrete units complying with PCI MNL-116 for structural units including dimensional tolerances.

Fabricate precast concrete lintel units complying with PCI MNL-117 for architectural units including exposed finishes.

INSTALLATION OF EMBEDDED ITEMS:
Set and build into precast units anchorage and connection devices, and other items required for other work that is attached to, or supported by precast units.

PART 3 - EXECUTION

EXAMINATION:
Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance of the Work.

Proceed with installation only after unsatisfactory conditions have been corrected.

Do not install precast concrete units until supporting, cast-in-place, building structural framing has attained minimum allowable design compressive strength or until supporting steel or other structure is complete.

ERECTION:
Do not erect precast units until concrete has attained its design ultimate compressive strength.

Contractor must shim the adjacent three planks each side of precast concrete planks that are of a shorter span than an adjacent longer span. Shims to make up for difference in amount of camber between adjacent planks that have a difference in span length and result in a different amount of camber.

Place units plumb, level, and in alignment. Provide temporary supports and bracing as required to hold units in position until permanently connected. Set units on appropriate bearing pads where required.

Anchor units in final position by bolting, welding, and grouting, as indicated.
At welded connections, apply touch-up coat of primer on painted surfaces and galvanizing repair material on galvanized surfaces.

GROUTING CONNECTIONS AND JOINTS:
After precast concrete units have been placed and secured, grout open spaces at connection and joints as follows:

Cement grout consisting of 1 part Portland cement, 3 parts sand, and only enough water to properly mix and for hydration. See Structural Sheet notes for further specifications.

Repair or replace unacceptable precast units as directed by Architect.

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SECTION 04 20 00
UNIT MASONRY

PART 1 – GENERAL

Applicable provisions of Division 1 shall govern all work under this section.

SECTION INCLUDES
Concrete Block.
Split Face Concrete Block.
Face Brick.
Reinforcement and Anchorage.
Flashings.
Accessories.

RELATED SECTIONS
Section 05 50 00 - Metal Fabrications: Loose steel lintels.
Section 06 10 00 - Rough Carpentry: Nailing strips built into masonry.
Section 07 21 00 - Foamed In Place Insulation: Insulation for cavity spaces.
Section 07 25 00 - Weather Barriers.
Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
Section 07 90 05 - Joint Sealers: Backing rod and sealant at control and expansion joints.

RELATED DOCUMENTS:
Applicable provisions of Division 1 shall govern work of this Section.

WORK INCLUDED:
This section specifies unit masonry assemblies consisting of concrete masonry units, stone, mortar and grout, reinforcing steel, masonry joint reinforcement, ties and anchors, embedded flashing and embedded plates.
Products installed but not furnished under this section include steel lintels, bearing plates, and anchor bolts.
Products supplied but not installed under this section include anchorages welded to steel columns, and steel lintels, reglets, reinforcement, dovetail anchor slots and items embedded in cast in place concrete.

UNIT MASONRY STANDARDS:
Comply with recommended practices and procedures of the following specification standards and with the modifications as specified herein.

ACI – American Concrete Institute:
TMS 402-08/ACI 530-08/ASCE 5-08 Building Code Requirements for Masonry Structures.
TMS 602-08/ACI 530.1-08/ASCE 6-08 Specifications for Masonry Structures.
ASTM International – American Society for Testing and Materials:

ASTM A82/A82M Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.


ASTM C954 Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.


SUBMITTALS:

Submit product data for masonry units, cementitious products for mortar and grout, and masonry accessories. Mix designs for each type of mortar and grout.

Submit samples of exposed masonry units.

Submit reinforcing steel shop drawings.

MOCK-UP

Construct a masonry wall as a mock-up panel sized 4 feet long by 4 feet high, which includes mortar and accessories and structural backup, wall reinforcing, flashing, insulation, weep holes.

Locate where directed.

Start no work until a dry 7 day old sample has been reviewed and approved by the Owner. If first sample is not approved, subsequent samples will be constructed until approved. The approved sample will remain on site to serve as a standard of appearance and construction.
PRE-INSTALLATION MEETING

Convene one week before starting work of this section.

QUALITY ASSURANCE:

Testing and Inspection Agency Services: The General Contractor shall retain a qualified testing and inspection agency to perform the services specified herein.

Fire Resistance Ratings: Where indicated, provide units that comply with requirements for fire resistance ratings indicated as determined by the testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

DELIVERY, STORAGE AND HANDLING

Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store pre-blended dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

PROJECT CONDITIONS

Protection of Masonry: During construction, cover tops of walls, projections, and sill with waterproof sheeting at end of each day’s work. Cover partially completed masonry when construction is not in progress.

Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.

Where on wythe of multi-wythe masonry walls is complete in advance of other wythes, secure cover in minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602-
Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602-08/ACI 530.1-08/ASCE 6-08.

EXTRA MATERIALS
Provide minimum of 25 split face block units for Owner's use in maintenance of project.

PART 2 – PRODUCTS

MASONRY UNITS, GENERAL:
Provide units of size indicated and in special shapes for applications where forms, size or finish cannot be produced from standard shapes.

Provide uncored or solid units with all exposed surfaces finished for sills, caps and similar applications exposing surfaces otherwise concealed from view.

CONCRETE MASONRY UNITS:
Provide Hollow loadbearing concrete masonry units complying with ASTM C 90 and as follows:

   Grade: N.
   Type: Type II non-moisture controlled units.
   Weight Classification: Normal weight.
   Net Area Compressive Strength: $f'_m = 2,000$ psi.

Exposed faces: Manufacturer's standard color and texture, unless otherwise indicated. Provide 8" o.c. scored block where noted on the drawings.

SPLIT FACE CONCRETE BLOCK: Full split face meeting ASTM C 145, Grade N, Type II, integrally colored with a water repellent additive admixture. Block color to be selected to match that on the adjacent HIGH SCHOOL that we are attaching to.

FACE BRICK: Shall be ASTM C216-95A, Grade SW, Type FBX, utility 3-5/8 x 3-5/8 x 11-5/8 size brick. Shall be included in the contractors proposal at a net cost of ($1.60 brick), unloaded at job site, sales tax not included. Before brick can be ordered, a +-3'x4' mockup must be done to confirm color and texture.

Basis of Design – to match existing Gym Brick is Beldon-St. Simon 8 x 47.

MORTAR AND GROUT MATERIALS AND MIXES:
Provide mortar complying with ASTM C 270, Proportion Specification, for materials and mortar types of composition indicated below:

   Type M mortar: Net are compressive strength = 2,500 psi.
   Type S mortar: Net are compressive strength = 1,800 psi.
Type N mortar: Nest area compressive strength = 750 psi.

Provide grout complying with ASTM C 476, with a compressive strength equal to or greater than $f'_{m}$, but not less than 2,000 psi.

Portland Cement: ASTM C 150, Type I natural color combined with hydrated lime. Mortar for face brick shall be cement-lime mortar.

Aggregate for Mortar: ASTM C 144, natural or manufactured sand.


Use Type M mortar for masonry below grade and in contact with earth.

Use Type S mortar for reinforced masonry and where indicated.

Use Type M or S mortar for exterior, above-grade loadbearing and non-loadbearing walls, and for other applications where another type is not indicated.

Use Type N mortar for interior partitions.

Do not add admixtures unless otherwise indicated. Do not use calcium chloride in mortar or grout.

Mortar for stone shall be of 750 psi minimum strength and shall be composed of one part Portland Cement, one part hydrated lime and 4-1/2 to 6 parts sand volume, to which shall be added Master Builders "Omicron" in the proportion of one lb. per each sack of Portland Cement and one lb. for each cu. ft. of lime, in exact accordance with manufacturer's directions.

**JOINT REINFORCEMENT, TIES AND ANCHORING DEVICES:**

Comply with requirements indicated below for basic materials and with those indicated under each item.

Manufacturers of Joint Reinforcement and Anchors:

- Dur-O-Wal
- Hohmann & Barnard, Inc.
- Masonry Reinforcing Corporation of America
- Or approved equal.

Hot-Dip Galvanized Steel Sheet: Carbon steel hot-dip galvanized after fabrication to comply with ASTM A 153, Class B.

Joint reinforcement: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10' and of widths to fit wall thicknesses indicated, with prefabricated corner and tee units, complying with ASTM A 951 and as follows:
Single-Wythe Interior Walls: Ladder type reinforcement with one 9 gage diameter side rod at each face shell and 9 gage cross ties.

Adjustable Multiple Wythe Joint Reinforcement: Truss type with adjustable ties or tabs spaced at 16 in on center and fabricated with moisture drip; ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/153M, Class B; 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inch wire; width of components as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from each masonry face.

Vertical adjustment: Not less than 2 inches.

Eye and pintle style.

Insulation Clips: Provide clips at tabs or ties designed to secure insulation against outer face of inner wythe of masonry.

Strap Anchors: Bent steel shapes configured as required for specific situations, 1-1/4 in width, 0.105 in thick, lengths as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face, corrugated for embedment in masonry joint, hot dip galvanized to ASTM A 153/A 153M, Class B.

Wall Ties: Corrugated formed sheet metal, 7/8 inch wide by 0.05 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.

CONCEALED FLASHING MATERIALS:

Vinyl masonry flashing: PVC with plasticizers and modifiers, formed into a 20-mil flexible sheet. An approved product is: WASOSEAL, 20 Mil by York Manufacturing, Inc. and Nervastral.

CONTROL JOINT GASKETS:

Premolded control joint strips: Solid rubber of profile as indicated (to maintain lateral stability of wall), 60-80 Shore A hardness.

PART 3 - EXECUTION

GENERAL:

Matching Existing Masonry Work: Match coursing, bonding, color and texture of new masonry work with existing work.

Install masonry units in running bond.

Cut exposed masonry units, where necessary, with a power saw.

Avoid the use (by proper layout) of less-than-half-size units.

No course of cut brick will be allowed.

Do not wet concrete masonry units.
Bond intersecting walls with masonry units to provide anchors spaced 2'-0".
Hold uniform joint sizes as indicated, or if not indicated, hold joint sizes to suit modular size of masonry units.
Cut joints flush and tool slightly concave, unless otherwise indicated.
Keep cavities clean of mortar droppings, and install ties spaced 16" vertically and 18" horizontally or 12" o.c. vertically and 24" o.c. horizontally. Provide weep holes spaced 24" apart at the bottom of (and at ledges in) cavities.
Provide control and expansion joints at locations shown, and keep clean of mortar droppings.
Protect newly laid masonry from exposure to precipitation, excessive drying, freezing, soiling, backfill and other harmful elements.
Dry-brush masonry work at end of each day's work.
All voids in exposed masonry wall surfaces shall be filled flush with adjacent surfaces.

**REINFORCING:**
Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.
Reinforcing bars shall be accurately positioned according to the drawings and shall be secured to prevent displacement during grouting.
Placing Reinforcement: Comply with requirements in TMS 402-08/ACI 530-08/ASCE 5-08.
Reinforce horizontal joints with continuous masonry joint reinforcement, spaced 16" vertically; and immediately above and below openings, for a distance of 2' beyond jambs of opening. Do not bridge control and expansion joints in the wall system.
Anchor ends of walls to structure with anchors spaced 2'-0", except as otherwise shown. Use galvanized corrugated wall ties.

**GROUTING OF WALLS:**
Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
Comply with requirements in TMS 402-08/ACI 530-08/ASCE 5-08 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

**FLASHING, WEEP HOLES AND VENTS:**
Provide concealed flashing in exterior masonry work as indicated. See Section 07 65 00 Flexible Flashing Stainless Steel and Section 04 05 23 Masonry Accessories.
Except as otherwise shown, provide flashing under copings and sills, through wall at counterflushing locations, and above elements of structural support for masonry.

Build other work into the masonry work as shown, fitting masonry units around other work, and grouting for secure anchorage.

**FINAL CLEANING:**

After mortar is thoroughly set and cured, clean masonry as follows:

Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.

Test cleaning methods on sample panels before proceeding with cleaning of entire masonry work.

Clean concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.

Acidic cleaner approved by unit masonry manufacturer.

Clean brick masonry by bucket and brush hand cleaning method described in BIA "Technical Note No. 20 Revised" using the following cleaner detergent or Acidic cleaner approved by unit masonry manufacturer.

**FIELD QUALITY CONTROL**

General Contractor shall hire an independent testing agency to assure quality assurance compliance as stated in the Specifications for Masonry Structures, Table 5 - Level C Quality Assurance and as specified herein.

System Performance Requirements: Provide unit masonry that develops the installed compressive strengths (f'm) indicated.

Fire Performance Characteristics: Where indicated, provide materials and construction identical to those of assemblies whose fire resistance has been determined per ASTM E 119 by a testing and inspecting organization, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

Field-Constructed Mock-Ups: Prior to installation of unit masonry, erect sample wall panel (control sample) of typical exterior unit masonry including joint reinforcement, rigid insulation, thru-wall flashings, end dams, air/vapor barrier and interior unit masonry, full height, of size and in location directed. Interior surface shall have block filler applied by painting contractor as specified. If acceptable to Architect, sample panel may be incorporated into work.

Finished Surfaces: Absolutely no chipped, broken, damaged, stained or discolored units will be accepted. Requirements of this section supersede workmanship acceptance of referenced masonry standards.
TESTING AND INSPECTION SERVICES:

The General Contractor will engage a qualified independent testing and inspection service to perform field quality control testing indicated below:

Testing Frequency: Material Tests Reports shall be conducted prior to the start of construction and addition reports shall be prepared for each additional 5,000 square feet of masonry wall construction.

Inspection Frequency: Inspection Reports shall be prepared at the start of construction and additional reports shall be prepared for each addition 5,000 square feet of masonry wall construction.

Contractor shall permit and facilitate access to the construction site by the Testing Agency, notify Testing Agency in advance of operations to allow for the prescribed testing and inspection to be completed and provide facilities for the sole use of the Testing Agency for safe storage and proper curing of test specimens on the project site.

Testing and inspection of masonry construction does not relieve the Contractor of the responsibility to furnish and install masonry assemblies in accordance with the requirements of the construction documents.

FIELD QUALITY CONTROL REQUIREMENTS:

The General Contractor shall retain a Testing Agency to perform testing and inspection by qualified parties as specified herein. Contractor shall permit and facilitate access to the construction site by the Testing Agency, notify Testing Agency in advance of operations to allow for the prescribed testing and inspection to be completed and provide facilities for the sole use of the Testing Agency for safe storage and proper curing of test specimens on the project site.

General: Structural Testing and Special Inspection services herein include items required by the 2009 IBC and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.

Special Inspection of masonry is required during preparation of masonry wall prisms or test specimens, sampling and placing of masonry units, placement of structural reinforcement, cleanout of grout space immediately prior to closing of elements, and during grouting operations.

Conventional Testing and Inspection Services specified herein describe those items not specifically required by the IBC, but are considered essential to the proper performance of the building system.

Definitions: Special inspectors.

Technical I: Inspector shall be employed by a testing laboratory, under the direct supervision of a Technical III.
Technical III: A civil / structural engineer regularly engaged in this type of work, with a minimum of 4 years experience and licensed in the State in which the Project is located. The licensed engineer shall review and approve all reports.

Structural I: Graduate civil/structural engineer with experience in the design of structural systems of this type. Inspector shall be under the direct supervision of a Structural II.

Structural II: Civil/structural engineer regularly engaged in the design of structural systems of this type, licensed in the State in with which the Project is located. The licensed engineer shall review and approve all reports.

Structural Testing and Special Inspection Requirements – Level C:

Samples and Tests for Special Inspections; performed by Technical I. Determine compressive strength by the Unit Strength Method or the Prism Test Method.

Unit Strength Method: Performed in accordance with ACI 530.1 as follows:

- Units conform to ASTM C55 or ASTM C90.
- Test units in accordance with ASTM C140 prior to the start of construction.
- During construction, one set of tests for each 5000 square feet of wall area, but not less than one set for the project.

Masonry Preparation and Placement; performed by Technical I.

- On a periodic basis, verify that masonry bearing surfaces are clean.
- On a periodic basis, verify that masonry units are clean, sound and dry.
- On a periodic basis, verify proportions of prepared mortar are consistent with previously submitted materials.

Masonry Preparation and Placement; preformed by Structural I.

- On a periodic basis, inspect laying of masonry units for nominal unit widths, stack or running bond, size and location of structural elements, proper thickness and tooling of mortar joints, and acceptable depth of furrowing of bed joints. Note temperature at time of inspection.
- On a continuous basis, observe selection of samples for masonry unit tests or preparation, storage, handling of test prisms, depending on method used. (Contractor shall provide all labor and materials to construct prism tests.)
On a periodic basis, inspect construction, expansion and contraction joints for location and continuity of steel.

On a periodic basis, verify hot and cold weather procedures are followed.

On a periodic basis, verify wall cavities are protected against entry of precipitation.

Masonry Reinforcement; performed by Structural I.

On a periodic basis, inspect placement and alignment of vertical bars and dowels for size, grade and spacing. Inspect length of lap splices, clearances between bars, clearances to masonry units and outside face of walls, and positioning of steel.

On a periodic basis, inspect horizontal joint reinforcement steel and masonry reinforcement bars for size, length of lap splices, dowels, clearances between bars, clearance for masonry units and outside face of walls, and alignment.

On a periodic basis, inspect ties in masonry for type, straightness, embedment, spacing and size.

On a periodic basis, inspect the type, size, location, and installation of masonry anchorage to structural members, frames, and other construction.

Prior to Masonry Grouting and Capping; performed by Structural I.

On a periodic basis, verify placement of reinforcement and connectors remains consistent with construction documents.

On a periodic basis, verify that grout spaces are correctly sized and clean, cleanouts are closed after inspection and grout barriers are in place before grouting.

On a periodic basis, verify proportions of site prepared grout are consistent with previously submitted materials.

During Grouting Operations; performed by Structural I.

On a continuous basis, verify proper grouting technique including consolidation to approved height of grout space, reconsolidation and vibration.

On a periodic basis, verify proper application of dry packing.

Conventional Testing: Submit field test reports for tensile bond strength between face brick and mortar in exterior walls.

* * * * * *
SECTION 04 72 00
CAST STONE MASONRY

PART 1 – GENERAL

Applicable provisions of Division 1 shall govern all work under this section.

SECTION INCLUDES
Architectural cast stone. An acceptable product is real limestone such as Indiana Limestone.

Units required are indicated on the drawings as “stone sills, banding & door & window heads”

RELATED SECTIONS
Section 04 05 11 - Masonry Mortaring and Grouting: Mortar for setting cast stone.
Section 04 20 00 - Unit Masonry: Installation of cast stone in conjunction with masonry.
Section 04 27 31 - Reinforced Unit Masonry: Installation of cast stone in conjunction with masonry.
Section 07 65 00 - Flexible Flashing Stainless Steel
Section 07 90 05 - Joint Sealers: Materials and execution methods for sealing soft joints in cast stone work.

REFERENCES
ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2005.
ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2006.
SUBMITTALS
See Section 01 30 00 - Administrative Requirements, for submittal procedures.

Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

Product Data: Test results of cast stone components made previously by the manufacturer.
 Include one copy of ASTM C 1364 for Architect’s use.

Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.

Mortar Color Selection Samples.

Verification Samples: Pieces of actual cast stone components not less than 12 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.

Full-Size Samples: One unit of each shape, for review.

Source Quality Control Test Reports.

QUALITY ASSURANCE
Manufacturer Qualifications: A current producer member of the Cast Stone Institute with a minimum of 5 years of experience in producing cast stone of the types required for project and:
 Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

 Products previously produced by plant and exposed to weather that exhibit satisfactory appearance.

Source Quality Control: Test compressive strength and absorption of specimens selected at random from plant production.
 Test in accordance with ASTM C 642.

 Select specimens at rate of 3 per 500 cubic feet, with a minimum of 3 per production week.

 Submit reports of tests by independent testing agency, showing compliance with requirements.

DELIVERY, STORAGE, AND HANDLING
Deliver cast stone components secured to shipping pallets and protected from damage and discoloration.
 Protect corners from damage.

Number each piece individually to match shop drawings and schedule.

Store cast stone components and installation materials in accordance with manufacturer's instructions.
 Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

Store mortar materials where contamination can be avoided.
Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

**PART 2 - PRODUCTS**

**MANUFACTURERS**
Architectural Cast Stone:
- Reading Rock, Inc. – Buffstone GP-A
- Edwards Stone
- Marc Stone, LLC
- Or approved equal

**ARCHITECTURAL CAST STONE**
- Compressive Strength: As specified in ASTM C 1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
- Freeze-Thaw Resistance: Demonstrated by field experience.
- Surface Texture: Fine grained smooth texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
- Color: Selected by Architect from manufacturer's full range.

Remove cement film from exposed surfaces before packaging for shipment.

Shapes: Provide shapes indicated on drawings.
Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.

Unless otherwise indicated on drawings, provide:
- Wash or slope of 1:12 on exterior horizontal surfaces.

Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.
- Pieces More than 12 inches Wide: Provide full length two-way reinforcement of cross-sectional area not less than 0.25 percent of unit cross-sectional area.

**MATERIALS**
Portland Cement: ASTM C 150.
- For Units: Type I or III, selected by Architect.
- For Mortar: Type I or II, except Type III may be used in cold weather.
Coarse Aggregate: ASTM C 33, except for gradation; granite, quartz, or limestone.
Fine Aggregate: ASTM C 33, except for gradation; natural or manufactured sands.
Pigments: ASTM C 979, inorganic iron oxides; do not use carbon black.
Admixtures: ASTM C 494/C 494M.
Water: Potable.

Reinforcing Bars: ASTM A 615/A 615M deformed bars, galvanized or epoxy coated.

Steel Welded Wire Reinforcement: ASTM A 185/A 185M, galvanized or epoxy coated.

Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.

Mortar: Portland cement-lime, ASTM C 270, Type N; do not use masonry cement.

Sealant: As specified in Section 07 90 05.

Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

**PART 3 - EXECUTION**

**EXAMINATION**
Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.

Do not begin installation until unacceptable conditions have been corrected.

**INSTALLATION**
Install cast stone components in conjunction with masonry, complying with requirements of Section 04 20 00.

Mechanically anchor cast stone units indicated; set remainder in mortar.

Setting:
- Drench cast stone components with clear, running water immediately before installation.
- Set units in a full bed of mortar unless otherwise indicated.
- Fill vertical joints with mortar.
- Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

Joints: Make all joints 3/8 inch, except as otherwise detailed.
- Rake mortar joints 3/4 inch for pointing. Scrub face of each stone to remove excess mortar before it sets.
- Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.

Sealant Joints: Install sealants as specified in Section 07 90 05.

Installation Tolerances:
- Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
- Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch
maximum.

Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.

Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

**CLEANING AND PROTECTION**

Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet. Repair with matching touchup material provided by the manufacturer and in accordance with manufacturer's instructions.

Repair methods and results subject to Architect's approval.

Clean cast stone components as work progresses; remove mortar fins and smears before tooling joints.

Clean exposed cast stone after mortar is thoroughly set and cured. Wet surfaces with water before applying cleaner.

Apply cleaner to cast stone in accordance with manufacturer's instructions.

Remove cleaner promptly by rinsing thoroughly with clear water.

Do not use acidic cleaners.

Protect from splashing by mortar and other damage.

**END OF SECTION**
SECTION 05 12 00

STRUCTURAL STEEL

PART 1 – GENERAL

RELATED DOCUMENTS:
Applicable provisions of Division 1 shall govern work of this Section.

WORK INCLUDED:
Furnish and erect structural steel.

RELATED WORK
Section 03 31 00 - Setting Anchor Bolts in Concrete.
Section 04 20 00 - Setting Anchor Bolts in Masonry.
Section 05 50 00 - Metal Fabrications.
Section 07 65 00 - Flexible Flashing Stainless Steel

REFERENCE CODES AND STANDARDS
Comply with recommended practices and procedures of the following standards and with modifications as specified herein:

AISC – American Institute of Steel Construction, Inc.
AISC – Code of Standard Practice for Steel Buildings and Bridges.
AISC – Specification for Architectural Exposed Structural Steel.

ASTM International – American Society for Testing and Materials:
ASTM A36 – Structural Steel.
ASTM A53 – Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
ASTM A108 – Steel Bars, Carbon, Cold-Finished, Standard Quality.
ASTM A123 – Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
ASTM A153 – Zinc Coating (Hot Dip) on Iron and Steel Hardware.
ASTM A307 – Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
ASTM A325 – Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
ASTM A490 – Heat-Treated Steel Structural Bolts, 150 KSI Minimum Tensile Strength.
ASTM A500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
ASTM A501 – Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
ASTM A563 – Carbon and Alloy Steel Nuts (Heavy Hex).
ASTM A572 – High Strength Low Alloy Structural Steel.
ASTM A992 – Steel for Structural Shapes for use in Building Framing.
ASTM F436 – Hardened Steel Washers.
ASTM F1554 – Steel Anchor Rods, Grades 36, 55, and 105.

AWS – American Welding Society:
AWS A2.0 – Standard Welding Symbols.
AWS D1.1 – Structural Welding Code.

RCSC – Research Council on Structural Connections:
RCSC – Specification for structural joints using ASTM A325 or A490 bolts.

SHOP DRAWINGS:
Shop Drawings: Show complete fabrication and erection details and schedules. Furnish anchor bolts required for installation in other work; furnish templates for bolt installation. Shop drawings shall have been thoroughly checked by Fabricator and General Contractor before being submitted for review.

QUALITY ASSURANCE:
Welders Certificate: Qualify procedures and personnel in accordance with AWS D1.1.
Fabricator Qualifications: At least 5 years of successful experience in fabrication of structural steel similar to the size and difficult of this Project.
Erector Qualifications: At least 5 years of successful experience in the erection of structural steel.

PART 2 – PRODUCTS

MATERIALS:
Rolled Wide Flange (W) shapes: ASTM A 992.
Steel plates, angles, channel shapes, bars: ASTM A 36.
Cold-formed steel tubing: ASTM A 500, Grade B.
Steel pipe: ASTM A 53, Type E or S, Grade B.
Fasteners: High-strength bolts and nuts, ASTM A 325 or A 490; unfinished bolts and nuts, ASTM A 307, Grade A.

Anchor bolts: ASTM A 307, plane finish.

**GROUT:**
Non-Shrink Grout: ASTM C 1107, Pre-mixed compound with non-metallic aggregate, cement, water reducing and plasticizing agents, capable of minimum compressive strength of 7,000 psi.

**FABRICATION:**
Comply with AISC "Specifications" and final shop drawings. Mark and match-mark units for field assembly.

**CONNECTIONS:**
As shown on final shop drawings. Use high-strength bolts for field connections, except as otherwise indicated.

Comply with AWS Code for procedures, appearance, and quality of welds.

**PROVISIONS FOR OTHER WORK:**
Fabricate structural steel members to provide holes for securing other work and for passage of other work through steel framing as indicated.

**SHOP PAINTING:**
Paint structural steel work, except members or portions of members embedded in concrete or mortar, contact areas to be welded and those members to fire proofed. Clean steel free of loose mill scale, rust, oil and grease. Apply prime paint to provide a minimum dry film thickness of 2.0 mils.

Shop Painting: Steel Structures Painting Council Specifications, SSPC-Paint 25 Type II, iron oxide, zinc oxide, raw linseed oil and alkyd. Apply prime paint to provide a minimum dry film thickness of 2.0 mils.

**PART 3 - EXECUTION**

**ERECTION:**
Comply with AISC 303 and AISC 360, and maintain work in safe and stable condition during erection. Provide temporary bracing and shoring as required; remove when final connections placed.

Set base plates on cleaned bearing surfaces, using wedges or other adjustments as required. Solidly pack open spaces with bedding mortar, consisting of 1 part portland cement to 3 parts sand and only enough water for packing and hydration, or use commercial non-shrink grout material at Erector's option.
Splice members only where shown on final shop drawings.

Touch-up prime paint after erection. Clean field welds, bolted connections and abraded areas, and apply same type paint as used in shop.

FIELD CONNECTIONS:

High Strength Bolts: Shop install high strength bolts according to RCSC’s “Specification for Structural Joints using ASTM A 325 and ASTM A 490 Bolts” for type of bolts and type of joint specified.

Joint Type: Snug tightened unless noted otherwise.

Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance and quality of welds.

REPAIRS AND PROTECTION / TOUCHUP PAINTING:

Immediately after installation, promptly clean exposed areas where primer is damaged or missing and prepare and prime paint or re-prime field connections, rust spots and abraded surfaces.

Clean and prime welds, bolt and rivet heads, abrasions of prime coat, and surfaces not previously shop primed, except surfaces to be in contact with concrete after erection.

Clean all surfaces of dirt, mud, oil, or grease that would impair bonding of fireproofing, concrete, or paint.

FIELD QUALITY CONTROL GENERAL

General Contractor will engage a qualified independent testing and inspecting agency to perform field quality control tests and inspections.

Structural Testing and Special Inspection Services herein include items required by the IBC 2009 and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.

If special inspection of fabricators work is required, testing agent may test and inspect structural steel at plant before shipment. Owner and structural engineer of record reserves the right to reject material not complying with Contract Documents at any time before final acceptance.

Field Quality Control Definitions:

Special Inspector – Technical: Shall be employed by a testing agency and shall be
supervised by an AWS/CWI with a minimum of 10 years experience or an ASNT Level III with a minimum of 10 years experience. Individuals shall satisfy the following requirements:

Technical I: Nondestructive Testing Technician ASNT TC – 1A level I, and or AWS Certified Associate Weld Inspector (CAWI).

Technical II: Nondestructive Testing Technician ASNT TC-1A Level II, (NDE Technician II), AWS/CAWI, with a minimum 3 years experience, or an ASW/CWI.

Technical III: ASNT Level III with minimum 10 years experience, or an AWS/CWI with a minimum of 10 years experience.

Special Inspector – Structural:

Structural I: Graduate civil/structural engineer, or other personnel acceptable to the structural engineer of record, with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a Structural II.

Structural II: Civil/structural engineer regularly engaged in the design of structural systems of this type, licensed in the State in which the Project is located. The licensed engineer shall review and approve all inspection reports.

Special Inspector – Structural may be the employee of the structural engineer of record.

Structural Testing and Special Inspection Requirements:

Test Field Bolted Connections: Performed by Technical II:

General:

- On a periodic basis, verify material conforms to specified ASTM Standards.
- On a periodic basis, visually inspect mating surfaces and bolt type for all slip-critical bolted connections for general conformance with Contract Documents prior to bolting.
- On periodic basis, verify that the requirements for bolts, nuts, washers, paint and installation/tightening standards are met.
- On a continuous basis, observe calibration procedures when such procedures are required by the installation method or the Contract Documents.

Bearing Bolts: On a periodic basis, visually inspect to verify all piles of connection elements have been brought into contact, at 100 percent of connections.
Test Shop Bolted Connections: Performed by Technical II. For shop fabricated work, perform tests required for field installation, except that bolt testing may be reduced or deleted, if fabrication so satisfies AISC Quality Certification Program – Category I, or more stringent criteria, or is approved by building official and structural engineer of record.

Welding General: Performed by Technical II.

Prior to start of fabrication, determine if fabrication shop meets the criteria for exempting shop welds from inspection and confirm in writing to building official and structural engineer of record.
Prior to start of fabrication, verify qualifications of welders as AWS certified.
Prior to start of fabrication, verify manufacturer’s certification of compliance for weld filler materials.
Prior to start of fabrication, verify proposed welding procedures and materials meet AWS requirements.
On a periodic basis, verify adequate preparation of faying surfaces.
On a periodic basis, verify preheat and interpass temperatures of steel, proper technique and sequence of welding, cleaning and number of passes are provided as required.

Welding Field: Performed by Technical II.

On a continuous basis, by the hammer test method, inspect 100 percent of all headed shear stud attachments and placement.
On a periodic basis, visually inspect 100 percent of all fillet welds 5/16” or less, for size, length, and quality, per AWS D1.1.
On a continuous basis, inspect welding process for all multi-pass fillet welds and single pass fillet welds greater than 5/16”.

Welding Shop: Performed by Technical II.

Perform inspections as for field welding except weld testing may be reduced or deleted, if fabrication shop satisfies AISC Certification Program – Category I, or more stringent criteria, and is approved by the building official and engineer of record.

Post Installed Concrete Mechanical Fasteners: Performed by Technical II.

On a continuous basis, visually inspect specified size, spacing, hole preparation, embedment and location.
Structural Configuration:

Submittals: Performed by Structural I. On a periodic basis, verify mill test reports and other submitted documentation, for compliance with Contract Documents.

Materials: Performed by Technical I. On a periodic basis, verify materials delivered to site, comply with Contract Documents and approved shop drawings. Materials include structural steel, bolts, electrodes, steel deck gage.

Detail Compatibility: Performed by Structural I. On a periodic basis:

Review Project documents affecting integrity of the structure, including Contract Documents, shop drawings and pertinent submittals.

Visit Site at intervals appropriate to the stage of construction, to perform review of the structure and visually confirm general compliance with the Project documents.

Inspect the following to verify member orientation, configuration, type, and size comply with details indicated on the Contract Documents and approved shop drawings.

Corrections to Work: Correct deficiencies in work that test reports and inspections indicate does not comply with the Contract Documents.

* * * * *
SECTION 05 21 00
STEEL JOIST FRAMING

PART 1 - GENERAL

RELATED DOCUMENTS:
Applicable provisions of Division 1 shall govern all work under this section.

SECTION INCLUDES
Open web steel joists, joist bridging, and accessories.

RELATED SECTIONS
Section 04 20 00 - Unit Masonry: Location of anchors for embedding into masonry.
Section 05 31 00 - Steel Decking: Support framing for decking.
Section 05 50 00 - Metal Fabrications: Non-framing steel fabrications attached to joists.
See Sheet S100 for additional specifications.

REFERENCES
SJI (SPEC) - Catalog of Standard Specifications and Load Tables for Steel Joists and Joist Girders; Steel Joist Institute; 2005.
SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; Steel Joist Institute; 1987.
SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).
SSPC-SP 3 - Power Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).
SUBMITTALS
Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.

Submit the name and contact information of the proposed Testing and Inspection Agency for approval by the Owner. The Testing and Inspection Agency shall demonstrate experience in the services required for a period of not less than 5 years.

QUALITY ASSURANCE:
Testing and Inspection Agency Services: The Steel Deck Contractor shall retain a qualified Testing and Inspection Agency to perform the services specified herein.

Design connections not detailed on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

Perform Work, including that for headers and other supplementary framing, in accordance with SJI Standard Specifications Load Tables and SJI Technical Digest No. 9.

Erector Qualifications: Company specializing in performing the work of this section with minimum 3 years documented experience.

DELIVERY, STORAGE, AND PROTECTION:
Transport, handle, store, and protect products to SJI requirements.

PART 2 - PRODUCTS

MANUFACTURERS:
Steel Joists:
   Canam Steel
   CMC Joist
   Vulcraft/Nucor Corporation
   Or approved equal.

MATERIALS
Open Web Joists: SJI Type K Joists:
   Provide bottom chord extensions as indicated.
   End bearing of 2 ½ inches on steel supports.
   End bearing of 4 inches on masonry supports.
   Finish: All joist to receive spray applied fire protection, unfinished.

Anchor Bolts, Nuts and Washers: ASTM A 307, hot-dip galvanized per ASTM A 153, Class C.

Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A 36.

Welding Materials: AWS D1.1; type required for materials being welded.

FABRICATION
Fabricate per SJI specifications.
Frame special sized openings in joist web framing as detailed.

Camber: Provide camber in accordance with SJI specifications.

**FINISH**
Prepare surfaces to be finished in accordance with SSPC-SP 2.

**PART 3 - EXECUTION**

**EXAMINATION**
Verify existing conditions prior to beginning work.

**ERECTION**
Erect joists with correct bearing on supports.

Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

After joist alignment and installation of framing, field weld joist seats to bearing plates.

Position and field weld joist chord extensions and wall attachments as detailed.

Install supplementary framing for roof openings greater than 16 inches.

Do not permit erection of decking until joists are braced bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

Do not field cut or alter structural members without approval of joist manufacturer.

After erection, prime welds, damaged shop primer, and surfaces not shop primed, except surfaces specified not to be primed.

**ERECTION TOLERANCES**
Maximum Variation From Plumb: 1/4 inch.
Maximum Offset From True Alignment: 1/4 inch.

**FIELD QUALITY CONTROL:**
The General Contractor shall engage a qualified independent Testing and Inspection Agency to preform field quality control tests and inspections.

All field welded joist connections shall be inspected by a qualified Testing Agency prior to installation of metal roof deck.

Correct any defects in fastener installation work as directed by Testing Agency.

**END OF SECTION**
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SECTION 05 31 00
STEEL DECK

PART 1 – GENERAL

SECTION INCLUDES
Applicable provisions of Division 1 shall govern all work under this section.

Section Includes:
Steel roof deck and accessories

RELATED SECTIONS
Section 05 12 00 – Structural Steel
Section 05 22 00 – Steel Joists & Girders
Section 05 50 00 – Metal Fabrications

REFERENCES
Codes and Standards:
American Iron and Steel Institute (AISI) "Specification for the Design of Cold-Formed Steel Structural Members"
American Welding Society (AWS) "Structural Welding Code – Sheet Steel"
Steel Deck Institute (SDI) "Design Manual for Composite Decks, Form Decks and Roof Decks"

SUBMITTALS
Shop Drawings: Include layout plans, deck type, deck gauge, anchorage details, and accessories.

DELIVERY, STORAGE, AND HANDLING
Deliver to site, store and protect decking on dry wood sleepers.

FIELD MEASUREMENTS
Verify that field measurements are as shown on shop drawings.

PART 2 - PRODUCTS

MANUFACTURERS:
Provide steel deck as fabricated by one of the following:
1. Epic Metals Corp.
2. United Steel Deck, Inc.
4. Wheeling Corrugating Co.

MATERIALS
Steel Roof Deck: Comply with SDI requirements for type of sections, gauge, width and depth as shown on the structural drawings.
Sheet Steel for Painted Units: ASTM A 611, Grade C or D.
Sheet Steel for Galvanized Units: ASTM A 653, Grade A.
Power Actuated Fasteners: Provide fasteners as manufactured by Hilti model X-EDN19 or X-EDNK22 nails or approved equal.

Side Lap Fasteners: Provide screws as manufactured by Hilti No. 10 self tapping screws or approved equal.

ACCESSORIES
Metal Accessories: Steel deck manufacturer’s standard accessory materials, including closure strips, roof sump pans and cant strips to match adjoining metal deck finish coating.

Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the decking.

FABRICATION
Fabrication: Form deck units in lengths to span at least 3 supports; flush, telescoped, or nested 2-inch end laps; nested or interlocked side laps, unless otherwise indicated.

Deck Units: Comply with SDI requirements for type of sections, of metal thickness, width, and depth indicated on drawings.

SHOP PRIMING
Shop Painted: Roof deck units shall receive manufacturer’s standard baked-on acrylic medium gray primer applied to chemically cleaned and pre-treated steel, except units exposed to weather or to be fireproofed.

Zinc Coated: Galvanized coating to comply with ASTM A 653 Class G-90 coating. Apply to all metal roof deck exposed to weather or to be fireproofed.

PART 3 - EXECUTION

EXAMINATION
Verify that field conditions are acceptable and are ready to receive work.

Beginning of installation means installer accepts existing conditions.

INSTALLATION
Erect metal decking in accordance with SDI Design Manual for Composite Decks, Form Decks, and Roof Decks.

Roof Deck Panels: Place deck panels on supporting framing and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Deck panels shall be continuous over three spans with not less than 1-1/2 inch minimum bearing on steel supports.

Metal Roof Deck Fasteners: Furnish and install power actuated or pneumatically driven fasteners in accordance with deck manufacturers’ instructions.

Side Lap Fasteners: Secure roof deck units at side laps with metal screws installed in accordance with manufacturer’s instructions.

Accessories: Place accessory units in accordance with manufacturer's recommendations unless otherwise shown.

Install single row of foam flute closures above walls and partitions perpendicular to deck flutes.

TOUCH-UP PAINTING
After installation, promptly clean all surfaces of dirt, mud, oil or grease that would impair bonding of touch-up coating.

Repair Painting: Wire brush and clean all rust spots and abraded areas of prime painted deck and apply repair paint.

Galvanized Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer’s instructions.

FIELD QUALITY CONTROL

The General Contractor shall engage a qualified independent Testing and Inspection Agency to perform field quality control tests and inspections.

Field Quality Control: All deck fasteners and side lap fasteners shall be inspected by a qualified testing agency prior to installation of insulation materials.

Correct any defects in fastener installation work as directed by testing agency.

END OF SECTION
SECTION 05 50 00
METAL FABRICATION

PART 1 – GENERAL

RELATED DOCUMENTS:
Applicable provisions of Division 1 shall govern work of this Section.

DESCRIPTION OF WORK:
Definition: Metal fabrications include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere.

WORK INCLUDED:
Types of work in this section include metal fabrications for:

Rough Hardware
Loose Bearing and Leveling Plates
Loose Steel Lintels
Steel Pipe Railings
Pre-Engineered Metal Stairs
Corruform for Concrete Entry Stoops

RELATED WORK:
Section 03 31 00 - Concrete Work and Toppings.
Section 03 41 00 - Precast Concrete.
Section 04 20 00 - Masonry.
Section 07 65 00- Flexible Flashing Stainless Steel

SUBMITTALS:
Submittals: In addition to product data, submit the following:

Shop drawings showing details of fabrication, assembly and installation including templates for anchor bolt placement.

Structural calculations sealed by a registered Structural Engineer, for metal stair framing components.

Samples of materials and finished products as may be requested by Architect

QUALITY ASSURANCE:
Provide assemblies which, when installed comply with the following minimum requirements for structural performance, unless otherwise indicated.
Stairs and Landings: Fabricate stairs, landings and components to support uniform loads of 100 psf or a concentrated load of 300 pounds. Limit stair deflections of stringers and landings to 1/360 of the span or 3/8" whichever is less.

Handrails: Capable of withstanding the following loads when tested per ASTM E 935. Concentrated load of 200 lbs. applied at any point in any direction. Uniform load of 50 lb. per linear foot, applied in any direction.

Guards: Intermediate rails, balusters and panel fillers; uniform load of 25 lbf per sq. ft. of gross area of guard, including open areas.

Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

Welding Qualifications: Qualify procedures and personnel according to the following:

AWS D1.1/D1.1M, “Structural Welding Code – Steel”.
AWS D1.2/D1.2M, “Structural Welding Code – Aluminum”.
AWS D1.6, “Structural Welding Code - Stainless Steel”.

PART 2 - PRODUCTS

MATERIALS/FABRICATION:
General: For work exposed to view use materials selected for their smoothness and freedom from surface blemishes.

STEEL MATERIALS:
Wide Flange Shapes: ASTM A 572, Grade 50.
Steel plates, angles, channel shapes and bars: ASTM A 36.
Steel tubing: ASTM A 500 or ASTM A 501.
Structural steel sheet: ASTM A 570 or ASTM A 611, Class 1; of grade required for design loading.
Galvanized structural steel sheet: ASTM A 446, of grade required for design loading; coating designation G90 or as indicated.
Steel pipe: ASTM A 53, type and grade as required for design loading (if applicable), black finish; standard weight (Schedule 40).
Brackets, flanges and anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
Malleable-Iron Castings: ASTM A 47.
Concrete inserts: Threaded or wedge type; galvanized ferrous castings, either galvanized ferrous
castings, malleable iron, cast steel; with steel bolts, washers and shims; hot-dip galvanized.

Aluminum bar gratings: ASTM B 221, alloy 6061-T6 or 6063-T6 for bearing bars, alloy 6061-T1 for cross bars.

Nonshrink metallic grout: Premixed, factory-packaged, ferrous aggregate grout complying with CE CRD-C 621.

Nonshrink nonmetallic grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD-C 621.

Fasteners: Provide bolts, nuts, lag bolts, machine screws, wood screws, toggle bolts, masonry anchorage devices, lock washers as required for application indicated and complying with applicable Federal standards. Hot-dip galvanize fasteners for exterior applications to comply with ASTM A 153.

Shop painting: Apply shop primer to surface of metal fabrications except those embedded in concrete or galvanized; comply with SSPC-PA1 and requirements indicated below:

Surface preparation: Comply with SSPC-SP6 "Commercial Blast Cleaning" for exterior work, and with SSPC-SP3 "Power Tool Cleaning" for interior work.

Shop primer: Fabricator's standard, fast-curing, lead-free, "universal" primer complying with performance requirements of FS TT-P-645.

Stripe paint edges, corners, crevices, bolts, welds and sharp edges.

Galvanizing: ASTM A 386 for assembled products; ASTM A 123 for rolled, pressed and forged steel shapes, plates, bars and strip 1/8" and thicker; galvanizing repair paint: MIL-P-21035 or SSPC- Paint-20.

Fabrication, general: Use materials of size and thickness shown or, if not shown, of required size, grade and thickness to produce strength and durability in finished product. Shop-paint all items not specified to be galvanized after fabrication.

Weld corners and seams continuously; grind exposed welds smooth and flush.

Form exposed connections with hairline, flush joints; use concealed fasteners where possible.

Rough hardware: Furnish custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes for framing and supporting and anchoring woodwork.

PART 3 - EXECUTION

GENERAL METAL FABRICATION INSTALLATION:
Perform cutting, drilling and fitting required for installation; set work accurately in location, alignment and elevation, measured from established lines and levels. Provide anchorage devices and fasteners where necessary for installation to other work.

Set loose items on cleaned bearing surfaces, using wedges or other adjustments as required. Solidly pack open spaces with bedding mortar, consisting of 1 part portland cement to 3 parts sand and only enough water for packing and hydration, or use commercial non-shrink grout material.

Touch-up shop paint after installation. Clean field welds, bolted connections and abraded areas, and apply same type paint as used in shop. Use galvanizing repair paint on damaged galvanized surfaces.

**LOOSE BEARING PLATES:**
Provide for steel items bearing on masonry or concrete, as shown. Drill plates to receive anchor bolts.

**LOOSE STEEL LINTELS:**
Fabricate to sizes shown.

**SHELF ANGLES:**
Fabricate to sizes indicated for attachment to support framing. Provide slotted holes to receive anchor bolts, spaced not more than 6" from ends and 24" o.c.

Furnish wedge-type concrete inserts complete with fasteners for securing shelf angles to cast-in-place concrete.

**STEEL PIPE RAILINGS, HANDRAILS AND GUARDRAILS:**
Fabricate steel pipe railings and handrails to design, dimensions, and details indicated. Provide railings and handrails members formed of pipe of sizes and wall thickness indicated, but not less than that required to support design loading. Use 1 1/2" square tube steel. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated. Welds to be continuous and ground smooth.

At tee and cross intersections provide coped joints.

Form bends by use of prefabricated elbow fittings and radius bends or by bending pipe, at fabricator's option.

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.

Provide wall returns at ends of wall mounted handrails, except where otherwise indicated.

Close exposed ends of pipe by welding 3/16" thick steel plate in place or by use of prefabricated fittings.
Brackets, flanges, fittings and anchors: 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. Contractors to use surface flanges.

STEEL FRAMED STAIRS:

General: Construct stairs to conform to sizes and arrangements indicated; join pieces together by welding unless otherwise indicated. Provide complete stair assemblies including metal framing, hangers, struts, clips, brackets, bearing plates and other components necessary for the support of stairs and platforms and as required to anchor and contain the stairs on the supporting structure. Stair loading design for 100 lbs. per square foot. Provide Shop Drawings for approval.

Stair framing: Fabricate stringers of structural steel channels, or plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers and newels and framing members to stringers and headers; fabricate and join so that bolts, if used, do not appear on finish surfaces.

Metal pan risers, subtreads and subplatforms: Shape metal plans for risers and subtreads to conform to configuration shown. Provide thicknesses of structural steel sheet for metal pans indicated but not less than that required to support total design loading.

Stringers: Manufactured from A36 structural grade steel, 7 ga. or greater (depending upon span and/or width).

Risers: Manufactured from 14 ga. or greater (depending upon span) hot rolled mild steel.

Treads: Pour-in place concrete, from 14 GA. or greater ASTM-569 steel and concrete in fill field applied.

Wall rail: 1-1/2” square tube steel single strand with brackets, factory-attached. 1-1/2" space between wall and rail.

Landing Railing: 1-1/2” square tube steel single strand.

Finish: All American Stair products to be finished with one shop coat of American Stair primer, per Government Specification TT-P-636. Finish paint to be provided by Section 09900 - Painting-In Field - all exposed parts.

MANUFACTURER:

American Stair Corporation, Inc.
One American Stair Plaza
Willow Springs, Illinois 60480
Telephone: 1-800-872-7824

Other manufacturers will be approved if considered equal by the Architect. See Instructions To
Bidders, Division 1, Article 3.3, Substitutions.

Applicable standards: American Stair products meet or exceed all applicable national and/or local building codes, including: UBC, BOAC, SBCCI, Life-Safety, National Building Code, and ANSI A117.1. Materials meet or exceed all applicable ASTM standards.

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

Applicable provisions of Division 1 shall govern all work under this section.

SECTION INCLUDES
Wall sheathing
Preservative treatment of wood
Miscellaneous framing and sheathing
Telephone and electrical panel boards
Wood nailers and curbs for roofing and items installed on roof
Roofing cant strips
Miscellaneous wood nailers and furring strips

RELATED SECTIONS
Section 05 21 00 – Steel joist framing
Section 05 50 00 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing
Section 07 62 00 - Sheet Metal Flashing and Trim: Sill flashings

REFERENCES
AFPA T10 - Wood Frame Construction Manual; American Forest and Paper Association; 2001
ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005
ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2005a
AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; American Wood-Preservers' Association; 2002
AWPA C9 - Plywood -- Preservative Treatment by Pressure Processes; American Wood-Preservers' Association; 2003
AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood-Preservers' Association; 2005
PS 1 - Construction and Industrial Plywood; National Institute of Standards and Technology (Department of Commerce); 1995
PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005
WCLB (GR) - Standard Grading Rules for West Coast Lumber No. 17; West Coast Lumber Inspection
QUALITY ASSURANCE
Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
Acceptable Lumber Inspection Agencies: Any agency with rules approved by American Lumber Standards Committee.
Acceptable Lumber Inspection Agencies: RIS, SPIB, WCLB, and WWPA.
Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

DELIVERY, STORAGE, AND HANDLING
General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 - PRODUCTS
DIMENSION LUMBER FOR CONCEALED APPLICATIONS
Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).
Grading Agency: West Coast Lumber Inspection Bureau (WCLB).
Grading Agency: Western Wood Products Association (WWPA).
Sizes: Nominal sizes as indicated on drawings, S4S.
Moisture Content: S-dry or MC15.
Stud Framing (2 x 2 through 2 x 6):
Species: Any allowed under referenced grading rules.
Grade: No. 2.
Miscellaneous Blocking, Furring, and Nailers:
Lumber: S4S, No. 2 or Standard Grade.
Boards: Standard or No. 3.
CONSTRUCTION PANELS

Roof Sheathing: APA Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
  Span Rating: 24/0.
  Thickness: 5/8 inch, nominal.
  Contractors have option of using oriented strand board as equivalent to plywood.

Other Applications:
  Electrical Component Mounting: APA rated sheathing, fire retardant treated.

Soffits: 1/2" or 15/32" APA Rated Sheathing, Exterior 1, 32/16, Douglas Fir.
  Fasten with 8d common nail 6" o.c. at panel edges and 12" o.c. intermediate supports. Sheathing shall be
  installed with edges supported, if not with wall plates then with blocking. Space panels 1/8" at
  ends and edges.

ACCESSORIES

Fasteners and Anchors:
  Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity
  and preservative-treated wood locations, unfinished steel elsewhere.
  Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of
  sheathing.
  Anchors: Toggle bolt type for anchorage to hollow masonry. Anchor bolts for wall plates to
  masonry walls to be 3/4 inch diameter, 9 inches long, 48 inches on center unless otherwise
  noted. Anchor bolts to be placed 12 inches maximum in each direction from the corners.
  Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
  For contact with preservative treated wood in exposed locations, provide minimum G185
  galvanizing per ASTM A 653/A 653M.

Sill Gasket on Top of Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.

FACTORY WOOD TREATMENT

Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for
wood treatments determined by use categories, expected service conditions, and specific applications.
Preservative Pressure Treatment of Lumber Above Grade: AWPA Use Category UC3B, Commodity
Specification A (Treatment C2) using waterborne preservative to 0.25 lb/cu ft retention.
  Kiln dry lumber after treatment to maximum moisture content of 15 percent.
  Treat lumber in contact with masonry or concrete or installed as blocking on roof decks.
Preservative Pressure Treatment of Plywood Above Grade: AWPA Use Category UC2 and
UC3B, Commodity Specification F (Treatment C9) using waterborne preservative to 0.25 lb/cu
ft retention.
  Treat plywood in contact with masonry or concrete.

PART 3 - EXECUTION

FRAMING INSTALLATION

Select material sizes to minimize waste.
Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

Install structural members full length without splices unless otherwise specifically detailed.

Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA Wood Frame Construction Manual.

Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.

Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

Provide miscellaneous members as indicated or as required to support finishes, fixtures, specialty items, and trim.

Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

**INSTALLATION OF ACCESSORIES AND MISCELLANEOUS WOOD**

Place sill gasket directly on wall. Puncture gasket cleanly and fit tightly to protruding foundation anchor bolts.

Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

Coordinate curb installation with installation of decking and support of deck openings.

**INSTALLATION OF CONSTRUCTION PANELS**

Roof Sheathing: Secure panels perpendicular to framing members, with ends staggered and sheet ends over firm bearing.

Use sheathing clips between roof sheathing panels at span midpoint and between roof framing members.

Provide solid edge blocking between sheets.

Nail panels to framing; staples are not permitted. Secure to framing with 8d common nail at 6 inches o.c. at panel edges and at 12 inches o.c. at intermediate supports. Sheathing to meet over trusses but do not butt tight.

**SITE APPLIED WOOD TREATMENT**

Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
Allow preservative to dry prior to erecting members.

TOLERANCES
Framing Members: 1/4 inch from true position, maximum.
Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum.

CLEANING
Waste Disposal:
Comply with applicable regulations.
Do not burn scrap on project site.
Do not burn scraps that have been pressure treated.
Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION
SECTION 06 20 00
FINISH CARPENTRY

GENERAL
Applicable provisions of Division 1 shall govern work of this Section.

WORK INCLUDED
Interior oak trim. To be stained and varnished by Section 09900.

See drawings for notes and details of miscellaneous finish wood carpentry items such as, but not limited to:

1) Display cases trim and plywood.
2) Plastic laminate stools.
3) Wall cap at half wall.
4) Plastic Laminate seat at lockers.

RELATED WORK
Section 06 10 00 - Rough Carpentry
Section 06 41 00 - Custom Casework
Section 08 52 00 - Aluminum Window
Section 09 90 00 - Painting

FINISH LUMBER
Comply with PS 20 and applicable grading rules of respective grading and inspection agency for species and product indicated. Manufacture to sizes and patterns using kiln seasoned lumber. Use pieces made from solid lumber for transparent finished work and glued-up or solid, at contractor's option for painted work.

Oak Trim: Rift-sawn Red Oak free of knots, checks, planer marks, etc. Wood to be sanded prior to being stained and varnished. Screw heads to be recessed and covered with a wood plug, sanded smooth adjacent surfaces.

INSTALL finish carpentry work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Scribe and cut finish carpentry items to fit adjoining work. Anchor finish carpentry work securely to supports and substrates using concealed fasteners and blind nailing where possible. Use fine finishing nails for exposed nailing except as indicated, countersunk and filled flush with finished surface.

STANDING AND RUNNING TRIM Install with minimum number of joints possible using full-length pieces from maximum length of number available. Cope at returns, miter at corners to produce tight fitting joints. Use scarf joints for end-to-end joints.
MATERIALS AND FABRICATIONS

General: Optimum Moisture Content: Kiln-dry wood work to an average moisture content within the following ranges as recommended by Standards for the regional climatic conditions involved.

Interior Woodwork: 6% to 11%.

Plywood: Oak veneered by sizes indicated on Drawings. See details.

Plastic Laminate Stool: To be general purpose .050 plastic laminate over 3/4" 45 lb. density minimum core particleboard or seven ply plywood. Plastic laminate to be installed on all exposed faces, edges and ends, and edge aluminum windows. Plastic laminate shall be routed and filed smooth edged. Install stool to substrate with construction adhesive.

Section 10 80 00 for robe hooks.

FASTENERS AND ANCHORAGES

Provide nails, screws and other anchoring devices of type, size, material and finish suitable for intended use and required to provide secure attachment, concealed where possible. Hot-dip galvanized fasteners for work exposed to exterior and high humidity’s to comply with ASTM A 153.

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SECTION 06 41 00
CUSTOM CASEWORK

GENERAL
Applicable provisions of Division 1 shall govern work of this Section.

WORK INCLUDED
Furnish and install modular custom plastic laminate casework, countertops and related supports. Coordinate with mechanical and electrical work specified in other Sections of Specifications.

RELATED WORK
Section 09 65 00 - Vinyl Base
Division 15 - Plumbing Fixtures

DESCRIPTION OF WORK
Extent of cabinets is indicated on drawings and shall include:
- Plastic laminated countertops - particle board core.
- All cabinetry as shown on interior elevations indicated as plastic laminate.
- Sliding and swing doors.
- Adjustable shelves, locks.
- All plastic laminate covered caps and trim.
- All plastic laminate shelving.

QUALITY ASSURANCE
Countertop Standard: ANSI A161.2.

Field Measurements: Verify sizes and shapes of all casework prior to fabrication by field measurements taken after walls are installed. Verify with Architect upon shop drawing preparation and submittal and by actual field construction dimensions of finished rooms to adjust for exterior wall thickness changes.

ACCEPTABLE MANUFACTURERS
Manufacturers requesting approval shall submit evidence of at least five year experience and installations for similar type of project. Manufacturers shall also show evidence of financial stability, plant facilities, catalogs and specifications. Full-sized samples, catalogs and specifications shall be submitted with written request for approval. Samples may be impounded by Owner and retained until completion of job for verification and compliance of specifications.

Architect/Owners opinion and decision shall be final in evaluation of manufacturers products.
SUBMITTALS

Product data: Submit manufacturer's technical product data and installation instructions indicating materials, hardware, and finishes used in fabrication of cabinets, as required to show compliance with specifications.

Shop drawings: Submit shop drawings showing location and size of each type of cabinet and countertops, accessories, materials, finishes, hardware types and locations, fillers, etc. Include fully dimensioned plans and elevations and indicate details of anchorage to countertop and to walls.

Sizing units: Break down size of large units into modules small enough to bring into the building via the doors. Show how this will be done on the shop drawings.

Samples: Submit fully finished cabinet samples and the following:

- Plastic laminate, 12" square, for each type of finish.
- Exposed hardware, one unit of each type and finish.

JOB CONDITIONS

Maintain temperature and humidity in installation areas as required to maintain moisture content of installed cabinet work within a tolerance range of the optimum moisture content acceptable to cabinet manufacturer, from date of installation through remainder of construction period.

DEFINITIONS

Exposed portions of cabinets include all surfaces including edges visible when doors and drawers are closed. Also included are visible surfaces and visible edges of shelves in open cabinets or underside of bottoms of cabinets over 4'-0" over floor.

Semi-exposed portions of cabinets include surfaces behind opaque doors and drawer fronts including shelves, dividers, interior faces of cabinet ends, backs, tops and bottoms, drawer sides backs and bottoms, and back face of doors. Also included are underside of bottoms of cabinets between 2'-0" and 4'-0" from floor and flat tops 5'-9" or more above floor.

Concealed portions of cabinets include sleepers, web frames, dust panels and other surfaces not normally visible after installation, including underside of bottoms of cabinets less than 2'-0" above floor.

BASIC MATERIALS

- Particleboard: ANSI A208.1 mat-formed particleboard, Grade 1-M-2 with minimum density of 45 lbs. per cu. ft., internal bond of 60 psi; and minimum screw holding capacity of 225 lbs. on faces and 200 lbs. on edges.
- Plastic laminate: NEMA LD-3, of thickness, type and grade designation indicated; in colors or
patterns and finishes as indicated, or, if not indicated, as selected by Architect from manufacturer's standard selections.

Hardboard: ANSI A135.4, Class 1, tempered.

Decorative boards: (Inside cabinets) Low pressure melamine plastic laminate composite panels complying with NEMA LQ 1, of thickness and type indicated; in Almond color.

PLASTIC LAMINATE CABINETS
Exposed surfacing material of doors, drawer fronts, fixed panels and ends: High pressure plastic laminate, 0.028" thick, General Purpose Type (GP-28).

Semi-exposed surfacing material and doros: High pressure plastic laminate, 0.020" thick, Cabinet Liner Type (CL-20), in color or pattern and finish matching interior of cabinets, unless otherwise indicated.

Concealed materials: Any sound, dry solid lumber, plywood or particleboard or combination thereof; without defects affecting strength, utility or stability. On concealed surfaces of portions constructed of decorative boards, provide decorative or cabinet liner laminate backing (Light-Duty Type).

Core material for plastic laminates: Particleboard and plywood.

Treatment of exposed and semi-exposed edges: Edge doors and drawer fronts and remaining portions of cabinets with high pressure plastic laminate not less than 0.028" thick matching adjoining plastic laminate in colors or patterns and finish, unless otherwise indicated.

Style of face construction: Flush overlay style: Provide base, wall and full height units with drawer fronts, doors and fixed panels overlaying and concealing face frames of cabinet body, unless otherwise indicated.

Note: If wood grain plastic laminate is selected, the grain on drawer fronts shall run in the same direction as doors.

Cabinet Construction:
Doors and drawer fronts: 3/4" thick, flush overlay design. 1/8" space between doors maximum.

Sides, dividers, tops, bottoms, shelves and stretchers: Not less than 3/4" thick. Provide stretchers at top of base cabinet. Shelves at 4'-0" wide units shall be 1-1/8" thick. Fixed shelf at 7'-0" high units shall be secured to sides to prevent sides from bowing out.

Backs: Not less than 1/4" thick hardboard.

Wherever there is required vertical shelf standards or brackets - provide a minimum 3/4" thick particle board substrate with plastic laminate finish if exposed surface or melamine decorative boards if semi-exposed. At wardrobe units, vertical divider to be held back 1" for door mounted mirror clearance.
Drawers: Sides, subfronts and backs: option of 5/8" particleboard or 1/2" hardwood, bottoms: not less than 1/4" thick. Provide box type construction with front, bottom and back rabbeted in sides and secured with glue and mechanical fasteners.

Joinery: Dadoed backs flush into end panels and secure with concealed mechanical fasteners. Connect wall cabinet tops and bottoms and base cabinet bottoms and stretchers to ends and dividers by means of mechanical fasteners. Dadoed tops, bottoms and backs into end panels.

Subbase: Not less than 3/4" thick, of height and relationship to cabinet fronts and exposed ends as indicated.

Toe board: To be covered with 4" vinyl base per Section 09650.

Cabinets forming an interior corner shall have the doors open a full 90 degrees without interference with adjacent cabinet.

### COUNTERTOPS

Exposed surfacing material: High pressure plastic laminate 0.050" thick, General Purpose. Scuff and abrasion resistant plastic laminate equal to APR by Nevamar. Color to be by Owner.

Substrate (core) for exposed surfacing material: Particleboard. Bottom front edge shall be solid wood.

Countertop configuration: Provide countertops with the following front styles (nose), and backsplash style, unless otherwise indicated:

Countertop: High-pressure plastic laminate on particleboard (3/4", with built-up edges (1-1/2") and integral back-splash (3-3/4")); 0.042" thick general purpose plastic laminate, post-forming, low gloss finished selected by Owner.

Construction: Continuous sheet (post-formed) with water fall-and-cove back-splash and bull-nose edge. Provide end splashes. Same height at backsplash. Countertop shall butt into sidesplash and be anchored to sidesplash.

Edges of holes cut in countertops: Such as at sinks, computer counter edges shall be sanded smooth and sealed for water impermeability with varnish. Bottom front edge face of exposed solid wood shall receive one coat of varnish or be finished with plastic laminate surface.

### CABINET HARDWARE

General: Provide manufacturer's hardware units of type, size and finish indicated, complying with ANSI A156.9, of type, material, size and finish indicated, or, if not indicated, as selected by Architect from manufacturer's standard choices.

Door and drawer pulls: Stanley 4483 1/2 with US26D finish - 3-1/2" centers.

Concealed Hinges: Blum - 170 Degree. Provide four hinges per tall door (over 4'-0" high).
Drawer Slides: Blum BS230E 6500 at 30" deep base, BS230E5000 at 24" deep base. Bottom mounted drawer slide.

Adjustable shelves shall be adjustable on 32 MM or 1-1/4" centers. Provide supports of all metal pin clips L shape, 5MM bore nickel finish, Model 1F-1345NP-C.

Locks and thumb catches: Provide door locks and thumb catches on cabinet units shown on interior elevations of the drawings. Cylinder lock to be equal to Natural Lock, C8053-4G, Antique Brass. Keyed alike each room but different from adjoining room, but not masterkeyed to building locks. Thumb catches to be cabinet manufacturers standard.

Elbow Catches: Amerock AM-BP3675-2G.

Grommets - Doug Mocket RG Series.

Other hardware items shall be the manufacturers standard.

End Brackets Shelf Standards: Knape & Vogt #255 or 256 Series for adjustable shelves.

Cabinet Drawer Locks: provide door locks on cabinet units as shown interior elevations of the drawings, and elsewhere where it is called for. Keyed alike for each but not masterkeyed to building locks. Cylinder lock to be equal to Knape and Vogt #986.

For cabinets in reception areas, cabinets noted as file drawer/file cabinets, these drawers to be equipped with a hanging file system Grass 6100 Series Rail System with a pendafl ex extrusion.

FABRICATION

Fabricate cabinets to dimensions and profiles and details indicated.

Assemble units in shop in as large components as practicable to minimize field cutting and jointing.

INSTALLATION

Install cabinets plumb, level, true and straight with no distortions. Shim as required using concealed shims. Provide filler strips, scribe strips and mouldings as indicated or required, and in finish to match cabinet face.

Anchor cabinets securely in place with concealed (when doors and drawers are closed) screw fasteners, anchored into structural support members of wall construction. Comply with manufacturer's instructions for support of units.

Attach countertops securely to base units. Spline and glue joints in countertops; provide concealed mechanical clamping of joint. Provide cutouts for fixtures and appliances as indicated; drill pilot holes at corners before making cutouts. Smooth cut edges and coat with waterproof
coating or adhesive.

Complete hardware installation and adjust doors and drawers for proper operation.

FIELD QUALITY CONTROL
The maximum permitted deviation from flatness for laminate doors shall be .036" per lin. ft.
The maximum gap between doors, drawers, or doors and drawers shall be 1/8" plus or minus 1/16".
The maximum variation from flushness for flat laminate joints shall be .010".

CLEANING AND PROTECTION
Repair or remove and replace defective work as directed upon completion of installation.
Clean exposed and semi-exposed surfaces, touch-up finish as required. Remove and refinish
damaged or soiled areas.
Protection: Advise Contractor of final protection and maintained conditions necessary to ensure that
work will be without damage or deterioration at time of acceptance.

* * * * *
SECTION 07 19 00  
VAPOR BARRIERS  

PART 1 - GENERAL  

Applicable provisions of Division 1 shall govern all work under this section.  

DESCRIPTION OF WORK  

Provide and install vapor barriers under interior concrete floor slabs, and on bottom of roof trusses and walls.  

PART 2 - PRODUCTS  

VAPOR BARRIERS  

Under floor slab vapor barrier is written in Section 03 31 00-CAST-IN-PLACE CONCRETE.  

On bottom of trusses and walls install actual 6 mil carbonated polyethylene film rated at .10 perms or less.  

PART 3 - EXECUTION  

INSTALLATION  

Extend vapor barriers to extremities of areas to be protected from vapor transmission.  Secure in place with adhesives or other anchorage system as indicated.  Extend vapor barriers to cover miscellaneous voids in insulated substrates, including those which have been stuffed with loose fiber-type insulation.  

Seal joints/seams in vapor barriers, seal to objects penetrating barriers, and seal to other surfaces at extremities of coverage by lapping with acoustical sealant adhesive or taping to form a continuous barrier.  

Lap edges of sheets of 10 mil vapor barrier not less than 24" under floor slab and seal lap joint by embedding the lapped vapor barrier in a continuous bead of acoustical sealant.  All penetrations of the vapor barrier (electrical boxes, piping, etc.) shall have the vapor barrier sealed to penetration with acoustical sealant.  Lap up side walls a minimum of 9". 

On ceiling, seal all laps by embedding the lapped vapor barrier in a continuous bead of acoustical sealant.  All penetrations of the vapor barrier (electrical boxes, piping, etc.) shall have the vapor barrier sealed to the penetration with acoustical sealant.  Vapor barrier shall lap bottom of trusses by one truss space.  

On walls, apply over inside face of wall framing/furring.  Lap joints one stud space and seal all laps with a continuous bead of acoustical sealant.  All penetrations through the barrier to be sealed to the vapor barrier.  

Vapor barrier under slab shall not be installed until a day before concrete will be poured.  

Repair punctures and tears in vapor barriers, immediately before concealment by other work.  Cover with adhesively applied vapor barrier material or with self-adhesive vapor barrier tape approved by manufacturer.  

END OF SECTION
SECTION 07 21 00
THERMAL INSULATION

PART 1 - GENERAL

Applicable provisions of Division 1 shall govern all work under this section.

SECTION INCLUDES
Board insulation at cavity wall construction, perimeter foundation wall and underside of floor slabs.
Expanding foam insulation in masonry wall block cores.

RELATED SECTIONS
Section 04 20 00 - Unit Masonry.
Section 07 19 00 - Vapor Barriers.
Section 07 25 00 - Weather Barriers: Separate air barrier and vapor retarder materials.
Section 07 53 00 – Flexible sheet roofing system.: Board insulation specified as part of roof system.

REFERENCES

SUBMITTALS
Product Data: Provide data on product characteristics, performance criteria, and product limitations.
Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

ENVIRONMENTAL REQUIREMENTS
Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.
Protect insulation from harmful weather exposures and physical abuses by temporary covering or enclosure. Advise Architect if sources of deterioration are encountered.

SEQUENCING
Sequence work to ensure fireproofing and firestop materials are in place before beginning work of this section.

COORDINATION
Coordinate the work with Sections 07 19 00 and 07 25 00 for installation of vapor barrier and air/vapor retarder.

PART 2 - PRODUCTS

APPLICATIONS
Insulation Under Concrete Slabs: Extruded polystyrene board.
Insulation Inside Cavity Walls: Extruded polystyrene board.
Insulation on Inside of Foundation Walls: Extruded polystyrene board.

Insulation in Masonry Block Cores: Amino-plast resin foam insulation.

**BOARD INSULATION MATERIALS**

Extruded Polystyrene Board Insulation: ASTM C 578, Type X; Extruded polystyrene board with either natural skin or cut cell surfaces; with the following characteristics:

Flame Spread Index: 75 or less, when tested in accordance with ASTM E 84.

Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.

Board Size: 48 x 96 inch.

Board Thickness: 2 inches.

Board Edges: Square.

Thermal Conductivity (k factor) at 25 degrees F: 0.18.

Compressive Resistance: 15 psi in cavity walls and inside face of foundation walls, 25 psi perimeter foundation and under concrete slab, 60 psi where under a drive surface area.

Board Density: 1.3 lb/cu ft.

Water Absorption, maximum: 0.3 percent, volume.

Manufacturers:
- Dow Chemical Co.
- Owens Corning Corp.
- Pactiv Building Products
- Or approved equal.

**INJECTED FOAM INSULATION:** Foam in place in exterior wall block cores, two component thermal insulation of plastic resin and catalyst foaming agent.

Flame Spread: 0.

Smoke Developed: 5.

R Value of 4.9/inch; ASTM C 177.

Equal to Core-Fill 500 by Tailor Chemical Products.

**ACCESSORIES**

Adhesive: Type recommended by insulation manufacturer for application.

**PART 3 - EXECUTION**

**EXAMINATION**

Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.

Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

**BOARD INSTALLATION AT CAVITY WALLS**

Install boards to fit snugly between wall ties and to adjacent boards.

Place membrane surface against adhesive.

Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
Place 6 inch wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames. Tape seal in place to ensure continuity of vapor retarder and air seal.

FOAM IN PLACE INSULATION
Expanding foam in masonry block cores to be installed after walls are erected per manufacturer’s instructions. Foam to fill entire cavity. Repair holes in block cores with the same mortar to construct the wall, joints struck to match existing and excess mortar on block face rubbed smooth. Repair area shall not be visible after wall has been painted.

PROTECTION OF FINISHED WORK
Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION
SECTION 07 24 00
EXTERIOR INSULATION AND FINISH SYSTEMS

PART - GENERAL

Applicable provisions of Division 1 shall govern all work under this section.

SECTION INCLUDES
Composite wall cladding of rigid insulation and reinforced finish coating.
Incidental uses of same finish coating applied directly to substrate.

RELATED SECTIONS
Section 07 25 00 - Weather Barriers: Separate air barrier and vapor retarder materials.
Section 07 62 00 - Sheet Metal Flashing and Trim: Perimeter flashings.
Section 07 90 05 - Joint Sealers: Perimeter and penetration sealants.

REFERENCES


SUBMITTALS

Shop Drawings: Indicate wall and soffit joint patterns, joint details, and molding profiles.

Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.

Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.

Verification Samples: Submit actual samples of selected coating on specified substrate, minimum 12 inches square, illustrating project colors and textures.

Manufacturer's Installation Instructions: Indicate preparation required, installation techniques, and jointing requirements.

QUALITY ASSURANCE

Maintain copy of specified installation standard and manufacturer's installation instructions at project site at all times during installation.

EIFS Manufacturer Qualifications: Provide all EIFS products other than insulation from the same manufacturer with qualifications as follows:

   Member in good standing of EIMA (EIFS Industry Members Association).

   Manufacturer of EIFS products for not less than 5 years.

   Manufacturing facilities ISO 9002 certified.

Insulation Manufacturer Qualifications: Approved by manufacturer of EIFS and approved and labeled under third party quality program as required by applicable building code.

Installer Qualifications: Company specializing in EIFS work, with not less than 3 years of documented experience, and approved by the EIFS manufacturer.

DELIVERY, STORAGE, AND HANDLING

Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.

Storage: Protect adhesives and finish materials from freezing and temperatures in excess of 90 degrees F. Protect insulation materials from exposure to sunlight.
ENVIRONMENTAL REQUIREMENTS
Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.

Do not install finish or sealants when ambient temperature is below 40 degrees F.

Do not leave installed insulation board exposed to sunlight.

WARRANTY
Provide manufacturer's standard material warranty, covering a period of not less than 5 years.

PART 2 - PRODUCTS

MANUFACTURERS
Dryvit System, Inc.
Sto Corp.
BASF Wall Systems, Senergy, Senerflex Channeled Insulation Design

Or approved equal.

EXTERIOR INSULATION AND FINISH SYSTEM
Exterior Insulation and Finish System: Reinforced finish coating on mechanically-fastened insulation board over substrate; provide a complete system that has been tested to show compliance with the following characteristics; include all components of specified system and substrate(s) in tested samples.

Fire Characteristics:
Flammability: Pass, when tested in accordance with NFPA 285.

Ignitibility: No sustained flaming when tested in accordance with NFPA 268.

Fire Resistance: Provide custom testing or engineering analysis acceptable to the authorities having jurisdiction that shows that the addition of the EIFS assembly to the fire-rated assembly will not reduce the fire-rated assembly rating; test in accordance with ASTM E119.

Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability (above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot.

Adhesion of Water-Resistive Coating to Substrate: For each combination of coating and substrate, minimum flatwise tensile bond strength of 15 psi, when tested in accordance with ASTM C 297/C 297M.

Adhesion to Water-Resistive Coating: For each combination of insulation board and substrate, when tested in accordance with ASTM C 297/C 297M, maximum adhesive failure of 25 percent unless flatwise tensile bond strength exceeds 15 psi in all samples.

Water Penetration Resistance: No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes, when tested in accordance with ASTM E 331 at 6.24 psf differential pressure with tracer dye in the water spray; include in tested sample at least two vertical joints and one horizontal joint of same type to be used in construction; disassemble sample if necessary to determine extent of water penetration.
Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 60 cycles, when tested in accordance with EIMA 101.01.

Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G 153 Cycle 1 or ASTM G 155 Cycle 1, 5, or 9.

Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D 2247.

Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D 3273.

Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D 968 with 500 liters of sand.

Impact Resistance: Construct system to provide the following impact resistance without exposure of broken reinforcing mesh, when tested in accordance with EIMA 101.86 or ASTM E 2486:

- Standard: 25 to 49 in-lb, for areas not indicated as requiring higher impact resistance.

MATERIALS

Finish Coating Top Coat: Water-based, air curing, acrylic or polymer-based finish with integral color and texture.

- Texture: Medium.
- Color: As selected from manufacturer's range of standard colors.

Base Coat: Fiber-reinforced, acrylic or polymer-based product compatible with insulation board and reinforcing mesh.

Reinforcing Mesh: Balanced, open weave glass fiber fabric, treated for compatibility and improved bond with coating, weight, strength, and number of layers as required to meet required system impact rating.

Insulation Board: Molded, expanded polystyrene board; ASTM C 578, Type I; with the following characteristics:

- Grooved Board: Back side of board adjacent to sheathing grooved with vertical channels designed to allow moisture to drain; at drainage points provide board configuration that permits drainage to the exterior.
- Board Size: 24 by 48 inches.
- Board Size Tolerance: +/-1/16 inch from square and dimension.
- Board Thickness: As indicated on drawings.
- Thickness Tolerance: +/-1/16 inch maximum.
- Board Edges: Square.
- Thermal Resistance (R factor per 1 in (25.4 mm)) at 75 degrees F: 3.60.
Board Density: 0.9 lb/cu ft.

Compressive Resistance: 10 psi.

Flame Spread Index: 25 or less, when tested in accordance with ASTM E 84.

Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.

Surface Burning Characteristics: Flame spread/Smoke developed index of 25/400, when tested in accordance with ASTM E 84.

Combination Drainage Layer/Water-Resistive Barrier: Air- and water-resistive sheet complying with ASTM E 1677 Type I, dimpled or otherwise profiled to maintain air and drainage space between insulation board and sheathing; MINIMUM water vapor permeance of 20 perms; furnished or approved by EIFS manufacturer.

Flashing Tape: Self-adhering rubberized asphalt tape with polyethylene backing or other material furnished or approved by EIFS manufacturer.

ACCESSORY MATERIALS

Insulation Adhesive: Type recommended by EIFS manufacturer for project substrate.

Insulation Fasteners: Fastener and plate system appropriate for substrate and as recommended by EIFS manufacturer.

Metal Flashings: As specified in Section 07 62 00.

Trim: EIFS manufacturer's standard PVC or galvanized steel trim accessories, as required for a complete project and including starter track, and drainage accessories.

Sealant Materials: As recommended by EIFS manufacturer.

PART 3 - EXECUTION

INSTALLATION - GENERAL

Install in accordance with EIFS manufacturer's instructions and ASTM C 1397.

Where different requirements appear in either document, comply with the most stringent.

Neither of these documents supercedes the provisions of the Contract Documents that define the contractual relationships between the parties or the scope of work.

EXAMINATION

Verify that substrate is sound and free of oil, loose materials, or protrusions that could interfere with EIFS installation and is of a type and construction that is acceptable to EIFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.

Verify that substrate surface is flat, with no deviation greater than 1/4 in when tested with a 10 ft straightedge.
**INSTALLATION - WATER-RESISTIVE BARRIER**

Apply barrier coating as recommended by coating manufacturer; prime substrate as required before application.

Mechanically attach sheet materials to substrate using fasteners and fastener spacing recommended by EIFS manufacturer.

Seal all substrate transitions and intersections with other materials with flashing tape, to form continuous water-resistive barrier on exterior of sheathing.

Lap flashing tape at least 2 inches on each side of joint or transition.

Install drainage layer or spacers after flashing tape has been completed.

**INSTALLATION - INSULATION**

Install in accordance with manufacturer's instructions.

Prior to installation of boards, install starter track and other trim level and plumb and securely fastened. Install only in full lengths, to minimize moisture intrusion; cut horizontal trim tight to vertical trim.

Install back wrap reinforcing mesh at all openings and terminations that are not to be protected with trim.

On wall surfaces, install boards horizontally.

Place boards in a method to maximize tight joints. Stagger vertical joints and interlock at corners. Butt edges and ends tight to adjacent board and to protrusions. Achieve a continuous flush insulation surface, with no gaps in excess of 1/16 inch.

Rasp irregularities off surface of installed insulation board.

Adhesive Attachment: Use method required by manufacturer to achieve drainage efficiency specified; do not close up drainage channels when placing insulation board.

**INSTALLATION - FINISH**

Base Coat: Apply in thickness as necessary to fully embed reinforcing mesh, wrinkle free, including back-wrap at all terminations of the EIFS. Install reinforcing fabric as recommended by EIFS manufacturer.

Lap reinforcing mesh edges and ends a minimum of 2-1/2 inches.

Allow base coat to dry a minimum of 24 hours before next coating application.

At locations indicated, install second layer of reinforcing mesh embedded in second coat of base coating, tightly butting ends and edges of mesh.

Apply finish coat after base coat has dried not less than 24 hours, embed finish aggregate, and finish to a uniform texture and color.

Finish Coat Thickness: 1/16 inch minimum.

Apply sealant at finish perimeter and expansion joints in accordance with Section 07 90 05.
CLEANING AND PROTECTION

1. Do not permit finish surface to become soiled or damaged.
2. Remove excess and waste EIFS materials from project site.
3. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

END OF SECTION
SECTION 07 25 00
WEATHER BARRIERS

PART 1 - GENERAL

Applicable provisions of Division 1 shall govern all work under this section.

SECTION INCLUDES
Air Barriers: Materials to stop passage of air through exterior walls, joints between exterior walls and roof, joints around frames of openings in exterior walls

RELATED SECTIONS
Section 07 19 00 – Vapor Barriers:
Section 07 90 05 - Joint Sealers: Sealant materials and installation techniques.

REFERENCES

SUBMITTALS
Product Data: Provide data on material characteristics.
Shop Drawings: Provide drawings of special joint conditions.
Manufacturer's Installation Instructions: Indicate preparation.

ENVIRONMENTAL REQUIREMENTS
Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 - PRODUCTS

APPLICATIONS
Outside Surface of Inside Wythe of Exterior Masonry Cavity Walls: Sprayed coating.

SPRAYED COATING
Sprayed Coating: Breathable Elastomeric, UV-resistant coating capable of being applied to damp masonry and green concrete without adverse effect on adhesion; complying with requirements of ASTM C 836 except for minimum film thickness. Asphalt emulsion based products are not acceptable.

   Film Thickness:  40 mils, minimum.

Air leakage per ASTM 2178 not to exceed .0016 cfm/ft²
Water vapor permeance per ASTM E96 of 11.6 perms maximum
Adhesion: Not less than 18 pounds-force per square inch when tested in accordance with ASTM C 836.
Application Temperature: From minus 20 degrees F to 100 degrees F.
Suitable for use on concrete and masonry.
Acceptable Products:

1. Poly Wall
2. Rubber Polymer Corporation
3. Henry Air Barrier
4. TK-AirMax 2104 VP
5. Or approved equal

Joint Filler: As recommended by coating manufacturer and suitable to the substrate.

SEALANTS

Primers, Cleaners, and Other Sealant Materials: As recommended by sealant manufacturer, appropriate to application, and compatible with adjacent materials.

ACCESSORIES

Thinners and Cleaners: As recommended by material manufacturer.

PART 3 - EXECUTION

EXAMINATION

Verify that surfaces and conditions are ready to accept the work of this section. All items attached to masonry or penetrating masonry shall be in place before beginning this portion of the work.

PREPARATION

Remove loose or foreign matter which might impair adhesion of materials.

Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

INSTALLATION

Install materials in accordance with manufacturer's instructions.

Install air and vapor seal materials and assemblies in conjunction with materials described in other sections to provide continuous sealed barrier in the exterior enclosure of the building.

Sprayed Coating: Fill large joints; tape joints in substrate and between dissimilar materials; install sprayed coating over entire exterior surface; seal to adjacent construction with compatible sheet.

Exterior Masonry Veneer: Install masonry anchors before installing air/vapor retarder; seal around anchors airtight.

At junction of exterior wall and roof join wall seal to roof deck and seal.

At window, door, and other wall openings install sheet seal transition strips between frame and adjacent wall seal material and attach with adhesive. Seal laps with sealant. Position lap seal over firm bearing. Provide a minimum 3 inch coverage over both substrates.

Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range

Adhere cavity wall insulation specified in Section 07 20 00 to the air/vapor barrier membrane after the initial set time and while the membrane is still tacky to prevent convection currents occurring behind the insulation.

END OF SECTION
SECTION 07 31 16
METAL SHINGLES

PART 1 - GENERAL

Applicable provisions of Division 1 shall govern all work under this section.

SECTION INCLUDES
Aluminum shingles.
Underlayment, including ice dam protection.
Fasteners and accessories.

RELATED SECTIONS
Section 06 10 00 - Rough Carpentry: Nailers and battens.
Section 07 62 00 - Sheet Metal Flashings and Trim: Roof flashing.

REFERENCES

SUBMITTALS
Product Data: Manufacturer's data sheets on shingles and underlayment, indicating material characteristics, installation instructions, and limitations and precautions.
Shop Drawings: For metal flashings and counterflashings, indicate overall configurations and thicknesses, details at complex intersections, jointing methods and locations, and fastening details.
Selection Samples: Submit color chips representing manufacturer's full range of available shingle colors and finishes.
Verification Samples: Set of shingles representing actual product in color, finish, and style, including special shapes and fittings.
Manufacturer’s Certificates: Certify that shingles supplied for the project meet or exceed specified requirements.

DELIVERY, STORAGE, AND HANDLING
Deliver and store materials in manufacturer's unopened packaging, with labels intact, until ready for installation.
Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
WARRANTY
Correct defective Work within a 5 year period after Date of Substantial Completion.

Provide manufacturer's minimum 10-year warranty against deterioration of shingle finish.

EXTRA MATERIALS
Supply 5 percent of shingles actually installed for Owner's use in maintenance of project, including appropriate quantities for each color, size, and shape of shingle installed.

PART 2 - PRODUCTS

MANUFACTURERS
Metal Shingles:
Design is based on Country Manor Shake shingles manufactured by Classic Metal Roofing Systems.

ROOF SHINGLES
Fire Rating: UL Class A.
Thicknness: Nominal 0.019 inch.
Weight: Nominal 46 lb/square.
Profile: Imitation wood shingle/shake.
Shingle Size: As selected from manufacturer’s standards (12” x 48”).
Vertical Exposure: Nominal 12 inches.
Finish: Two coat Kynar 500 or Hylar 5000.
Color: As selected from manufacturer’s standards.

Special Shapes and Fittings: Supply special shapes and fittings of same material and finish as adjacent shingles, factory-formed, as indicated on drawings or as required for specific project conditions, including but not limited to hip caps, ridge caps, rake edges, eave edges, and termination caps. Provide flared trim on gables.

SHEET MATERIALS
Underlayment: Self-adhering polymer-modified asphalt sheet complying with ASTM D 1970; minimum thickness of 40 mils; with strippable release paper and slip-resistant embossed polyethylene top surface.

Underlayment: Asphalt-saturated organic felt underlayment complying with ASTM D 4869, Type IV, 30 lb. felt.


METAL FLASHING MATERIALS
Provide metal roof flashing as specified in Section 07 62 00.

Provide metal roof flashings as indicated and as required for watertight roofing system, including eave edge, gable edge, ridge vent, and open valley flashing.

Form flashings to profiles indicated, or as required to shed water and protect building from water damage.

Form sections square, flat, and accurate to profile, in maximum possible lengths, free from distortion or other defects detrimental to function or appearance.

Hem exposed edges of flashings minimum 1/4 inch on underside.

Coat concealed surfaces of flashings with bituminous paint.

Aluminum: ASTM B 209 (ASTM B 209M), 3005 alloy, H12 or H14 temper; 0.032 inch thick; mill finish.
FASTENERS
Underlayment Fasteners: Hot-dip galvanized steel roofing nails, 11 gage thick, sharp pointed with barbed shanks, minimum 3/8 inch diameter head, and of length sufficient to penetrate 3/4 inch into substrate or completely through it.

Shingle Fasteners: Aluminum ring shank nails, minimum .090 inch thick, with minimum .215 inch diameter head, of sufficient length to penetrate 3/4 inch into solid substrate or completely through plywood sheathing.

Adhesive: Asphalt plastic roof cement conforming to ASTM D 4586, Type II, non-asbestos, heavy body mastic comprising asphalt and other mineral ingredients.

Roofing Mastic: Cold process modified bitumen type conforming to ASTM D 3019, type III.

ACCESSORIES
Provide manufacturer's standard accessories for starter strip, eave and gable drip edge, valley flashing, ridge caps, sidewall flashing and all other accessories required for a watertight installation.

PART 3 - EXECUTION

EXAMINATION
Examine structural roof deck for compliance with specified requirements. Verify that roof penetrations and roof openings are correctly installed in proper locations.

Do not begin installation of shingle roofing until substrates have been properly prepared. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

PREPARATION
Broom clean deck surface prior to installation of underlayment or eave protection.

Prepare roof deck surfaces using methods recommended by shingle manufacturer for achieving best results under project conditions.

Seal roof deck joints wider than 1/16 inch with deck tape.

At areas where elastomeric membrane underlayment will be installed, fill knotholes and surface cracks with latex filler, or cover knotholes with sheet metal.

Install eave edge and gable edge flashings tight with fascia, in accordance with SMACNA (ASMM) recommendations. Lap joints minimum 2 inches and seal with rubber butyl sealant.

INSTALLATION
Install metal shingle roofing system in accordance with recommendations of shingle manufacturer and in accordance with recommendations of NRCA Steep Roofing Manual (MS104).

Eave Protection: Install from eave edge to minimum 2 ft up-slope beyond projected interior face of exterior wall.

Install eave protection membrane in accordance with manufacturer’s installation instructions for project substrate.

Underlayment:
Install one layer of organic felt underlayment over entire roof area, perpendicular to roof slope, with ends and edges weather lapped a minimum of 6 inches horizontally and 18” vertically. Stagger end laps of each layer, and nail in place.

Apply additional layer of underlayment not less than 36 inches wide at valleys.

Valley Protection Membrane: Install full width elastomeric membrane underlayment centered at valleys, in
accordance with manufacturer’s installation instructions for project substrate. Weather lap joints a minimum of 12 inches.

Metal Valley Flashings:

Open Valleys: Install valley flashing over valley protection membrane, centered over valley and crimped to guide water; fasten to deck with cleats. Overlap end joints minimum 8 inches, blind nailing upper end of each sheet and seal.

Sheet Metal Flashing: Install flashing at other locations as indicated and as required by project conditions.

Install flashing at all locations where metal shingles intersect other roofs, walls, parapets, ventilators, and similar projections.

Install drip edge flashing at eaves prior to installing underlayment.

Install drip edge flashing on downslope roof edges after installation of underlayment.

Flexible Flashing: Apply flexible flashing in concealed locations where metal flashing would be difficult or impossible to apply effectively.

Metal Shingles:

Follow manufacturer’s written installation instructions.

Install first row of shingles at eaves with minimum projection as recommended by shingle manufacturer, set into starter strip.

Lay shingles square with building lines and parallel with roof slope. Install filler, closure, and mitered pieces as required.

Stagger joints between courses.

Shingles that run into the valley must be trimmed and folded over the open valley standing rib.

Nail shingles by driving nails to point where nail heads just clear surface of shingle, so shingles hang on nails. Do not overdrive nails, putting pressure on underlying shingles, and do not underdrive nails, putting strain on overlying shingles.

Cut and fit shingles neatly around vents, pipes, and other projections.

Set ridge shingles as recommended by shingle manufacturer.

Install accessories in accordance with manufacturer’s details and recommendations for a watertight installation.

ADJUSTING, CLEANING, AND PROTECTION

Minimize traffic over finished roof surface. Where walking on roof is absolutely necessary, wear soft-soled shoes and walk on upper half of shingles to avoid denting, deformation, and other damage.

Remove and replace damaged, dented, or deformed shingles before Date of Substantial Completion.

Remove excess and cut shingles and roof installation debris from project site.

END OF SECTION
GENERAL
Applicable provisions of Division 1 shall govern work of this Section.

WORK INCLUDED
Provide and install continuous strip vents and soffit louver in soffit as noted on the Drawings.

MATERIALS
Strip Vent: Shall be prefinished aluminum, 2-1/2" wide, minimum of 12 square inches free area per lineal foot equal to 669W Series, White Color by Leigh Industries. Install in coordination with the synthetic plaster finish on the soffit.

* * * * *
SECTION 07 53 00
FLEXIBLE SHEET ROOFING SYSTEM

PART 1 - GENERAL

RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

DESCRIPTION OF WORK: Work involves new fully adhered EPDM membrane roof, and tapered insulation, and roof wall cap.

INSTALLER: A firm with not less than 3 years of successful experience in installation of roofing systems similar to those required for this project and which is acceptable to or licensed by manufacturer of primary roofing materials.

PROJECT WARRANTY: Provide a minimum 15 year warranty, signed by the manufacturer of primary roofing materials and his authorized installer, agreeing to replace/repair defective materials and workmanship. Warranty shall begin from date of substantial completion.

SUBMITTALS: Submit technical data on roof membrane and installation instructions to Architect for approval.

FIRE PERFORMANCE CHARACTERISTICS: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction:

- Surface Burning Characteristics: ASTM E 84
- Fire Resistance Ratings: ASTM E 119
- Combustibility Characteristics: ASTM E 136

MATERIALS:
- EPDM membrane shall be 60 mil, black color throughout, Class A, equal to Firestone or Carlisle.
- Roof Insulation: Polyisocyanurate insulation with facers compatible to EPDM. Thickness to be tapered as shown to thickness as shown on roof plan.
- Miscellaneous Roofing Accessories:
  1) Flashing Material: Manufacturer's standard system compatible with flexible sheet membrane. Color to be Black.
  2) Sheet Seaming System: Manufacturer's standard materials for sealing lapped joints, including edge sealer to cover exposed spliced edges as recommended by membrane roofing manufacturer.
  3) Membrane Adhesive: As recommended by FSR membrane manufacturer for particular substrate and project conditions, formulated to withstand min. 90 psf uplift force.
  4) Roof Cap: Minimum 24 GA. galvanized steel with Kynar 500 finish coating, color to be selected. See drawings for profiles. Cap to have a continuous front and rear cleat. Minimum 8" wide concealed splice plates finished to match cap.
6) Wood Blocking: No pressure treated wood to be used

7) Flashing Accessories: Materials recommended by the roofing membrane manufacturer for the conditions present to provide for a watertight seal.

PREPARATION OF SUBSTRATE:
Review structural metal deck.

Clean substrate of dust, debris, and other substances detrimental to FSR system work. Remove sharp projections. Install insulation. Anchor insulation to metal deck with large head plates and screws in a manner to provide an I-90 wind rating or fully adhere insulation to metal deck.

Install cant strips, flashings, and accessory items as shown or as recommended by manufacturer even though not shown.

FSR MEMBRANE INSTALLATION: Follow manufacturer’s recommendations.
Install membrane by unrolling over prepared substrate, lapping adjoining sheets as recommended by manufacturer. Apply adhesive to surfaces to be bonded and roll FSR into place when adhesive has properly cured. Treat seams with special cement and apply sealant to exposed sheet edges, tapering application as recommended by manufacturer. Seams to be overlapped in the direction of the slope of the roof. Install flashings and counterflashings, and accessories at locations and as recommended by manufacturer. Adhesive color to match roofing. All flashings and termination bars to extend a minimum of 8" above the roof membrane unless otherwise noted. All flashings to be fully adhered to substrate.

Daily Seal: Care should be exercised to insure that the water does not flow beneath any completed sections of the roof. Loose edges of membrane should be temporarily sealed with uncured flashing, roof cement, pourable sealer or caulk that when the weather is threatening or finishing up for the day.

Coordinate installation of flashing with new metal cap and metal fascia on parapet walls. Install per manufacturer’s instructions.

PROTECTION: Any damage to this system shall be repaired before warranty acceptance of work and cost of repairs will be borne by contractor.

CLEAN UP: Contractor to remove all masking protection, equipment, materials and debris from the work and storage areas and leave those areas in an undamaged and acceptable condition.

* * * * *
SECTION 07 60 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

Applicable provisions of Division 1 shall govern all work under this section.

SECTION INCLUDES
Fabricated sheet metal items, including flashings, counterflashings, and other items as required.
Reglets and accessories.

RELATED SECTIONS
Section 04 20 00 – Unit Masonry.
Section 07 65 00- Flexible Flashing Stainless Steel
Section 07 71 23 - Manufactured Gutters and Downspouts.
Section 07 90 05 - Joint Sealers.

REFERENCES
ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.

SUBMITTALS
Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details. Contractor will be notified of required submittals at the preconstruction meeting.

QUALITY ASSURANCE
Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.
Maintain one copy of each document on site.
Fabricator and Installer Qualifications: Company specializing in sheet metal work with 3 years of documented experience.
DELIVERY, STORAGE, AND HANDLING
Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
Prevent contact with materials which may cause discoloration or staining.

PART 2 - PRODUCTS

SHEET MATERIALS
Stainless Steel: ASTM A 666 Type 304, soft temper, 26 gage; smooth No. 2B finish.

ACCESSORIES
Fasteners: Galvanized steel, with soft neoprene washers.
Sealant: One part polyurethane based specified in Section 07 90 05.
Plastic Cement: ASTM D 4586, Type I.

FABRICATION
Form sections true to shape, accurate in size, square, and free from distortion or defects.
Form pieces in longest possible lengths.
Hem exposed edges on underside 1/2 inch; miter and seam inside and corners using rivets and polyurethane sealant. Outside corners shall be prefabricated with outside section face broken at corner. Seam at corner is not acceptable. Pieces shall be 18 inch minimum length in both directions from the corner.
Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form a 3/4 inch drip leg.

PART 3 - EXECUTION

EXAMINATION
Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
Verify roofing termination and base flashings are in place, sealed, and secure.

PREPARATION
Install starter and edge strips, and cleats before starting installation.
Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.
Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

INSTALLATION
Wall Flashing: For through-wall flashings for masonry cavity walls.
Fabricate wall flashing to conform to actual dimensions of wall and as follows:
Exposed portion of flashing, when installed, shall break surface of wall uniformly.

Concealed portion of flashing shall have a minimum 4 inch vertical back dam; bend between back dam and horizontal shall be slightly greater than 90 degrees. End dams shall be a minimum of 1-1/2 inches in height.

Exposed portion of flashing shall have a 3/4 inch drip. Exposed portion of flashing shall be bent to act as the receiver for counterflashing installation.

Provide prefabricated continuous pieces at all internal/external corners; pieces shall be a minimum of 18 inches in length, in both directions from the corner.

Notch and lap joints 3 inches between sections. Apply a continuous bead of sealant within the lap.

All cut stone sill flashings shall have turned up ends and be sealed watertight.

Install flashings in accordance with Section 04 20 00.

Miscellaneous Flashings:
  Install appropriate flashings at all exhausts, vents and penetrations not specifically called out but required.

Remount and secure all rooftop equipment. Use threaded fasteners.

Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

Seal metal joints watertight.

END OF SECTION
SECTION 07 62 00
METAL FASCIA AND COPINGS

RELATED DOCUMENTS
Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to work of this Section.

DESCRIPTION OF WORK
Extent of metal fascia and copings is indicated on drawings and provisions of this section.

Types of work specified in this section include.

A. Aluminum Fascia and Gravel Stop.
B. Scuppers
C. Aluminum Coping System

RELATED WORK
Section 07 61 00 - Metal Roofing
Section 07 53 00 - Flexible Sheet Roofing System

QUALITY ASSURANCE
Industry Standards: Provide products which comply with applicable requirements of SMACNA "Architectural Sheet Metal Manual", except as otherwise indicated.

SUBMITTALS
Product Data: Submit manufacturer's technical product data, installation instructions and general recommendations for each fascia and coping product required. Include data substantiating that materials and performance comply with requirements.

Shop Drawings: Submit shop drawings indicating layout, joining, profiles, accessories, anchorages, flashing connections and relationship to supporting structure and to adjoining roof and wall construction.

Samples: For verification purposes submit completely finished samples for each type of fascia and coping to match existing finish. Where normal color and texture variations are to be expected, include 2 or more units in each set of samples showing limits of such variations. Provide samples of the following sizes:

Fascia: 8" long sections of fascia component that matches existing, including extenders (if any), exposed as finish work.

Copings: 8" long.
JOB CONDITIONS
Coordinate work of this section with adjoining work for proper sequencing of each installation to ensure best possible weather resistance and protection of materials and finishes against damage.

MATERIALS
Miscellaneous Materials: Concealed Fasteners: Same metal as item fastened or other noncorrosive metal as recommended by manufacturer.

FABRICATION, GENERAL
Provide fascia and copings which are designed and fabricated to fit applications indicated and to perform optimally with respect to weather resistance, water tightness, durability, strength, and uniform appearance.

Expansion Provisions: Fabricate fascia and copings to allow controlled expansion in running lengths not only for movement of metal components in relationship to one another but also to adjoining dissimilar materials, including flashing and roofing membrane materials, in a manner which is sufficient to prevent water leakage, deformation or damage.

SHEET ALUMINUM FASCIA SYSTEMS
Aluminum Gravel Stop: Provide and install at all exposed edges of roofs at synthetic panel or insulated panel areas (smooth) prefabricated aluminum Gravel Stops, one or two piece type to match existing building profile in sizes as shown on drawings, Kynar 500 finish. .040" minimum aluminum in 8' lengths with mastic covered concealed splice plates. Fascias of Gravel Stops shall not be nailed. Gravel stops shall be installed in strict accordance with printed directions of gravel stop manufacturers with continuous hold down cleats fastened at 2'-0" o.c. Provide mitered corners.

Roof Scupper: Provide standard gravel stop manufacturers spillout type scupper designed to fit fascia system components. Nominal 4" wide opening spillout.

Aluminum Coping: Provide and install at canopy smooth prefabricated one piece snap locky.040" minimum aluminum coping, Kynar 500 finish. Provide hold down cleat, concealed splice plate mitered corners, install in strict accordance of manufacturer.

Acceptable Manufacturers: Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Peterson Aluminum Corporation
Cheney Flashing Company
W.P. Hickman Company
Merchant and Evans Industries, Inc.
CLEANING AND PROTECTION

Clean exposed metal surfaces in accordance with manufacturer's instructions. Touch up damaged metal coatings.

Protection: Provide protective measures as required to ensure that work of this section will be without damage or deterioration at time of substantial completion.

* * * * * *

OPTIONS

Add to 9 if applicable:

Closure: Along bottom of fascia system, provide an extruded .080 aluminum continuous closure trim to conceal treated 2x6 and to act as a cleat to receive fascia. Finish to match fascia.

CANOPY FASCIA

Custom fabricate to cover existing wood fascia from .032" thick aluminum. Prefinished. Color selected by Owner.

SOFFIT PANELS11" wide .032" thick aluminum vee-panel roll-formed with grooves 4" o.c. with Kynar 500 Finish in color to match fascia.

Add to 9 if applicable:

FASCIA AND SOFFIT PANEL SYSTEMS

Formed Aluminum Panels: Provide manufacturer's standard modular panels formed from aluminum sheet not less than shapes and sizes indicated. Include trim, closure strips, and other accessories indicated or required for proper installation. Provide aluminum sheet of the following minimum thickness, unless otherwise indicated. Same panel to be used on soffit and fascia.

Thickness: 0.050"

The following specification is based on Moduline fascia panel system as manufactured by W.P. Hickman Company. Other manufacturers will be approved if considered equal by the architect. See Instructions to Bidders, Division 1, Article 3.3, Substitutions.

Acceptable Manufacturers:

Cheney Flashing Company, "Extruded Batten System".
W.P. Hickman Company- "Moduline Fascia Panel System"
Merchant and Evans Industries, Inc. - "Custom Form"

"Modu-Line" Fascia Panel System as manufactured by the W.P. Hickman Company.
Materials: Panels shall be .050 Formed Aluminum, and shall be designed to allow for expansion and contraction. 1" square lock-on battens shall be extruded aluminum. Head and sill trim shall be formed aluminum. Panels, battens and retainers shall be pre-cut at the factory to the required sizes. All appropriate fasteners shall be supplied by the manufacturer. Battens shall be spaced at a module of 18" as shown on the drawings.

Erection: Head and Sill trim shall be fastened to the supporting structure by others on 12" centers. Panels shall be secured by continuous extruded aluminum retainer sections. Fastener spacing not to exceed 12" with 5/8" minimum plywood backup. Apply lock-on battens of the type shown on the drawings. All materials shall be installed plumb and true to line. No exposed fasteners shall be used. Upon completion, the installing contractor shall clean all exposed components with soap and water or other methods, as recommended by the manufacturer.

Work not included: Supports for the panel fascia system, such as plywood back-up, shall be provided under another division of this specification.

Finish: All exposed components shall be finished in Kynar-500, color as selected.

Panel Criteria: Same panel profile shall be used on soffit and fascia with concealed fastening. Complete with trim accessories as detailed on drawings. No oil canning allowed.

Metal Fascia and Soffit Panel Support Framing System: Provide manufacturer's standard metal support system consisting of horizontal girts and vertical framing members including special connectors; of proper type for, and by manufacturer of, fascia panel system indicated. Provide components and spacing designed and tested to withstand the following loading:

Wind Pressure: 20 psf.

INSTALLATION

General: Comply with manufacturer's written installation instructions and recommendations. Coordinate with installation of roof deck and other substrates to receive work of this section, roof insulation, roofing membrane, flashing, and wall construction; as required to ensure that each element of the work performs properly, and that combined elements are waterproof and weathertight. Anchor products included in this section securely to structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

Isolation: Where metal surfaces of units are installed in contact with dissimilar metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation as recommended by aluminum producer.

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SECTION 07 65 00
FLEXIBLE FLASHING STAINLESS STEEL

PART 1 – GENERAL

Applicable provisions of Division 1 shall govern all work under this section.

SUMMARY
Laminated stainless steel fabric flashing, non-asphaltic.

RELATED SECTIONS
04 05 23 Masonry Accessories.
04 20 00 Concrete Unit Masonry
04 72 00 Cast Stone Masonry.
06 10 00 Rough Carpentry.
07 11 10 Damp proofing.
07 62 00 Flashing and Sheet Metal.

REFERENCES
Standards of the following as referenced:
1. ASTM
2. Brick Industry Association (BIA)
3. Recycled content & Recyclability

Industry standards:

DEFINITIONS
Terms:
1. Cavity wall flashing: Same as flexible flashing.
2. Foundation sill flashing: Same as flexible flashing.
3. Flexible flashing: Water-proof material typically used in cavity wall construction to contain and assist in the proper water drainage that may penetrate wall system veneer. Other materials may be required to constitute the system.
4. Head and sill flashing: Same as flexible flashing.
5. Through-wall flashing:
   a. Generally considered the same as flexible flashing.
   b. Rare definition referred to full width cap flashing under copings or wall caps.

SUBMITTALS
Product data: Indicate material type, composition, thickness, and installation procedures.

Samples: 3" by 5" flashing material.

Product Quality & Environmental submittals:
1. Certificates:
   a. Indicate materials supplied or installed are asbestos free.
   b. Indicate recycled content: 60% total recycled material; based on 60% Post Industrial Recycled Content.
2. Performance Attributes
   a. Tensile strength, 100,000 psi minimum average
   b. Puncture Resistance, 2,500 pounds average
   c. When tested as manufactured, product resists growth of mold pursuant to test method ASTM-D3273.
   d. Fire Rating: flame spread and smoke generation
1. Rated Class A, ASTM E84
d. Certify the use of domestic manufactured stainless steel for flashing.

QUALITY ASSURANCE
Qualifications:
1. Manufacturer: Provide flashing materials by single manufacturer with not less than twenty five years of experience in manufacturing flexible flashing products.
2. Flashing materials must be able to withstand 400º F temperature without changing the long term performance of the flashing.

WARRANTY
Special warranty:
1. Manufacturer: **Warrant flexible flashing material for life of the wall.**
2. Begin warranty at Date of Substantial Completion.

PART 2 - PRODUCTS
MANUFACTURED UNITS
Flexible flashing:
1. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified below, are acceptable for use subject to compliance with specified requirements. Product standard of quality is York Manufacturing’s Multi-Flash SS
   a. Product standard of quality:
      a. York Manufacturing, Inc.; Multi-Flash SS
      b. Illinois Products, Inc.; IPCO Stainless Steel Fabric Flashing
      c. Prosoco, Inc.; R-Guard SS ThruWall
      d. STS Coatings, Inc.; Gorilla Flash Stainless Fabric
      e. TK Products, Inc.; TK TWF
      f. Other products that meet the criteria in section 1.04 to 1.06.
   2. Characteristics:
      a. Type: Stainless steel core with polymer fabric laminated to one stainless steel face with non-asphalt adhesive.
      c. Fabric: polymer fabric; laminated back face of stainless steel core.
      c. Size: Manufacturer's standard width rolls.

ACCESSORIES
Mastic/sealant: Product standard of quality is York Manufacturing, Inc.; UniverSeal US100.
   1. Characteristics:
      a. Type: One part 100% solids, solvent-free formulated silyl-terminated polyether (STPE), ASTM C920-11, Type S, Grade NS, Class 50.
   Outside corner and inside corner material: manufacturer's standard available units using:
   2. Stainless steel: 26 gauge stainless steel.
   End dam: Product may be folded in line with the flashing material or utilize preformed end dams by manufacturer using:
   3. Stainless steel: 26 gauge stainless steel
   Splice material: Product standard of quality is York304 SS by York. Manufacturer’s standard self-adhered metal material; material matching system material or use Multi-Flash Stainless Steel 6” lap piece and polyether sealant as a splice.
   Termination bar: Product standard of quality is York T-96 termination bar. Manufacturer's standard 1” composite material bar or a 1” 26 gauge stainless steel termination bar with sealant lip.
Repair and other materials/accessories: Manufacturer’s standard.

Fasteners: Domestic manufactured fastener types and sizes recommended by flashing manufacturer for intended use.

PART 3 - EXECUTION

INSTALLATION

General:

1. Install where indicated, specified, or required in accord with flashing manufacturer's written instructions and as follows.
2. Extend flashing 6" minimum beyond opening. Fold flashing ends at end of openings or horizontal flashing terminations to form end dam or use pre-manufactured units made of 26 gauge stainless steel.
3. Flashing width: Width required starting flush with outside face of exterior wythe, extending through cavity, rising height required to extend above lintel steel at least 2".
4. Splice end joints by overlapping them 6" and seal with a compatible sealant or metal splice tape.
5. Masonry back up:
   a. Surface apply after dampproofing installation specified in Dampproofing Section in accord with manufacturer’s installation instructions.
   b. Fasten to masonry back-up surface at top by embedding in layer of sealant or use a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with compatible sealant or use a termination clamp, which is embedded in the block back up wall.
6. Concrete back up:
   a. Surface apply after dampproofing installation specified in Dampproofing Section in accord with manufacturer’s installation instructions.
   b. Fasten to concrete surface at top by embedding in layer of sealant or use a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with a compatible sealant.
7. Stud back up with sheathing:
   a. Fasten to stud back-up at top by embedding in layer of sealant or use a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with a compatible sealant.
8. Leave ready for certified compatible building felt or air barrier installation lapping flashing top installed in another Section.
9. Lay flashing in continuous bead of sealant on masonry supporting steel.
10. Fold ends of flashing at end of opening to form dam; seal with polyether sealant or use purchased manufacturers preformed end dams.
11. Inside and outside corners: Make in industry accepted manner using corner and splice material or purchase manufactured corners from manufacturer.
12. Cover flashing within a few days of installation to protect it from damage from the different trades, the environment and falling debris. If flashing is left unprotected and it is punctured, torn, or has loose scrim you should contact the manufacturer for repair instructions.

SCHEDULES

Locations:

1. Exterior door heads.
2. Window heads and sills.
4. Other wall openings.
5. Other locations indicated.

END OF SECTION 07 65 00
SECTION 07 81 00
APPLIED FIREPROOFING

PART 1  GENERAL

SECTION INCLUDES
Fireproofing of interior structural steel – See drawings for location of fireproofing application needs.

RELATED SECTIONS
Section 03 41 00 Precast Concrete
Section 05 12 00 Structural
Section 09 21 16 – Gypsum Board Assemblies
Section 09 51 00 – Acoustical Ceilings

REFERENCES

WORK INCLUDED
Exposed sprayed-on fireproofing for all exposed structural steel columns & beams as shown on drawings and noted in specifications shall receive a two hour sprayed-on fireproofing per U.L. Designs.

The types of sprayed-on fireproofing, defined to include those with combined acoustical or thermal performance requirements, specified as work of this section include the following:

1) Cemetitious aggregate fireproofing.
2) Sprayed fiber.

QUALITY ASSURANCE
Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
Applicator Qualifications: Company specializing in performing the work of this section, with minimum 3 years of experience.

PROJECT CONDITIONS
Sequence work in conjunction with placement of ceiling hanger tabs.

ENVIRONMENTAL REQUIREMENTS
Do not apply spray fireproofing when temperature of substrate material and surrounding air is below 40 degrees F.
Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.

Provide temporary enclosure to prevent spray from contaminating air.

**WARRANTY**

See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

Correct defective Work within a two year period after Date of Substantial Completion.

Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.

Reinstall or repair failures that occur within warranty period.

**PART 2  PRODUCTS**

**MANUFACTURERS**

Basis of Design is:  W.R. Grace and Co. Product:  MK-6 Series

Manufacturer’s standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project Site to form a slurry or mortar before conveyance and application.

Products: Subject to compliance with requirements, provide one of the following:

- Carboline Company; RPM International Pyrolite 15.
- Grace Construction Products; W.R. Grace and Co. – Conn; Grace Construction Products; Monokote MK-6 Series:
- Isolatek International, Inc.; Cafco 300.
- Pyrok, Inc.; Pyrok-MD
- Southwest Fireproofing Products Co.; Type 5GP

Bond Strength: Minimum 150-lb/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.

Density: Not less than 15 lb/cu. ft. and as specified in the approved fire-resistance design, according to ASTM E 605.

Thickness: As required for fire-resistance design indicated, measured according to requirements of fire resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch.


Surface Burning Characteristics:  Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- Flame-Spread Index:  10 or Less
- Smoke Developed Index:  10 or Less

Comprehensive Strength:  Minimum 10 lbf/sq. in according to ASTM E 761

Corrosion Resistance:  No evidence of corrosion according to ASTM E 937

Deflection:  No cracking, spalling, or delamination according to ASTM E 759

Effect of Impact on Bonding:  No cracking, spalling, or delamination according to ASTM E 760

Air Erosion:  Maximum weight loss of 0.025 g/sq. ft in 24 hours according to ASTM E 859

Fungal Resistance:  Treat products with manufacturer’s standard antimicrobial formulation to result in no growth on specimens per ASTM G 21 or rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273.
Finish: Spray-textured finish

ACCESSORIES
Primer Adhesive: Of type recommended by fireproofing manufacturer.

SPRAYED-ON CEMENTITIONS AGGREGATE FIREPROOFING AND SPRAYED-ON FIBER FIBERPROOFING

Scope: Contractor to verify and submit for approval only U.L. Designs to meet two hour rating for all construction conditions required on this project.

1) Work Included: Provide materials, labor, equipment and services necessary; furnish, deliver and install all work as shown on the drawings, as specified herein, and/or as required by job conditions.

Fireproofing is to be applied to steel beams per U.L. Design N401 and columns per U.L. Design Y710 of exposed structure, 2 hour rating. Fireproofing of beams supporting precast plank to be protected by UL P706 Design, 2 hour rated.

2) Following specifications based on W.R. Grace & Co. "Monokote" - other manufacturers listed acceptable to meet U.L. Design intent.

Products:

1) Materials: The sprayed fireproofing material shall be as manufactured by the firms approved or its processing distributors and shall be formulated without asbestos.

   a) Mixing water shall be clean, fresh and suitable for domestic consumption and free from such amounts of mineral or organic substances as would affect the set of the fireproofing material. Provide water with sufficient pressure and volume to meet the fireproofing application schedule.

Performance Criteria

1) The sprayed fireproofing shall have been tested by Underwriters Laboratories, Inc. or other certified testing agency in accordance with the procedures of ASTM E-119.

2) The sprayed fireproofing material shall have been sprayed onto structural members, the underside of decks after roofing applications have been completed and to other members indicated on the drawings with proper thickness and density to provide the following fire resistive ratings:

3) Primary and Secondary Members: Two Hour Rating on steel columns and beams.

   All areas with exposed steel or as noted on drawings.

4) For steel columns built in wall to be fire proofed per U.L. design X771, 2 hour rating with products equal to W.R. Grace & Company. Types MK-4 or MK-5, minimum 9/16" to 1" thick.

INTUMESCENT PAINT

See Structural drawings for locations calling for painting intumescent paint to steel structural where exposed to achieve hourly rating. NOTE: One Hour fire rating is to be achieved in all areas noted.

Intumescent paint specifications shall be Contractors options of using either trowel on product or spray on product equal to: Carboline “Thermo-Lag E100 (trowel on) OR Carboline “Thermo-Lag E100S (spray on).
Steel fabricator shall supply all involved steel components to get fireproofed with the aforesaid epoxy intumescent paint with a compatible primer approved by the epoxy finish coat manufacturer.

**PART 3 EXECUTION**

**EXAMINATION**
Verify that surfaces are ready to receive fireproofing.

Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.

Verify that voids and cracks in substrate have been filled. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

**PREPARATION**
Perform tests as recommended by fireproofing manufacturer in situations where adhesion of fireproofing to substrate is in question.

Remove incompatible materials that could affect bond by scraping, brushing, scrubbing, or sandblasting.

Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.

Apply fireproofing manufacturer's recommended bonding agent on primed steel.

Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

Close off and seal duct work in areas where fireproofing is being applied.

**APPLICATION**
Install metal lath over structural members as indicated or as required by UL Assembly Design Numbers.

Apply primer adhesive in accordance with manufacturer's instructions.

Apply fireproofing in sufficient thickness to achieve required ratings, with as many passes as necessary to cover with monolithic blanket of uniform density and texture.

**FIELD QUALITY CONTROL**
Inspect the installed fireproofing after application and curing for integrity, prior to its concealment. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings.

Re-inspect the installed fireproofing for integrity of fire protection, after installation of subsequent Work.

**CLEANING**
Remove excess material, overspray, droppings, and debris.

Remove fireproofing from materials and surfaces not required to be fireproofed.

At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

**END OF SECTION**
Applicable provisions of Division 1 shall govern all work under this section.

SECTION INCLUDES
Sealants and joint backing.
Precompressed foam sealers.
Hollow gaskets.

RELATED SECTIONS
Section 08 80 00 - Glazing: Glazing sealants and accessories.
Section 09 21 16 - Gypsum Board Assemblies: Acoustic sealant.
Section 09 30 00 - Tiling: Sealant used as tile grout.

REFERENCES

SUBMITTALS
Product Data: Provide data indicating sealant chemical characteristics.
Samples: Submit samples illustrating sealant colors for selection.
Manufacturer's Installation Instructions: Indicate special procedures.

QUALITY ASSURANCE
Maintain one copy of each referenced document covering installation requirements on site.
Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
Applicator Qualifications: Company specializing in performing the work of this section with minimum 3 years experience.

ENVIRONMENTAL REQUIREMENTS
Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
COORDINATION
Coordinate the work with all sections referencing this section.

WARRANTY
Correct defective work within a five year period after Date of Substantial Completion.

Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

MANUFACTURERS
Silicone Sealants:
  Bostik, Inc.
  GE Silicones
  Pecora Corporation
  BASF Construction Chemicals, Inc.
  Or approved equal.

Polyurethane Sealants:
  Bostik, Inc.
  Pecora Corporation
  BASF Construction Chemicals, Inc.
  Or approved equal.

Polysulfide Sealants:
  Pecora Corporation
  BASF Construction Chemicals, Inc.
  Or approved equal.

Acrylic Emulsion Latex Sealants:
  Bostik, Inc.
  Pecora Corporation
  BASF Construction Chemicals, Inc.
  Tremco
  Or approved equal.

Preformed Compressible Foam Sealers:
  Emseal Joint Systems, Ltd.
  Sandell Manufacturing Company, Inc.
  Dayton Superior Corporation
  Or approved equal.

SEALANTS
Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No. 1168.

General Purpose Exterior Sealant: Polyurethane; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; single component, non-staining to stone and masonry.
  Color: Standard colors matching finished surfaces.
Applications: Use for:
1. Control, expansion, and soft joints in masonry.
2. Joints between concrete and other materials.
3. Joints between metal frames and other materials.
4. Joints around exterior louvers.
5. Other exterior joints for which no other sealant is indicated.

General Purpose Interior Sealant: Acrylic emulsion siliconized latex; ASTM C 834, Type OP, Grade NF single component, paintable.
   Color: Standard colors matching finished surfaces.
   Applications: Use for:
   1. Interior wall and ceiling control joints.
   2. Joints between door and window frames and wall surfaces.
   3. Joints between gypsum board and masonry.
   4. Other interior joints for which no other type of sealant is indicated.

Bathtub/Tile Sealant: White silicone; ASTM C 920, Uses I, M and A; single component, mildew resistant.
   Applications: Use for:
   1. Joints between plumbing fixtures and floor and wall surfaces.
   2. Joints between kitchen and bath countertops and wall surfaces.
   3. Joints between janitor mop basin and wall/floor.

Acoustical Sealant: Butyl or acrylic sealant; ASTM C 920, Grade NS, Class 12-1/2, Uses M and A; single component, solvent release curing, non-skinning.
   Applications: Use for concealed locations only:
   1. Sealant bead between vapor barrier laps.

Penetrations in fire-rated assemblies:
   Foamed-In-Place Fire Stopping Sealant. Through penetrations in fire-resistance-rated floor and wall assemblies involving multiple pipes, conduits, etc.
   One-part fire stopping sealant: Through penetrations in fire-resistance-rated floor and wall assemblies involving single pipes, conduits where joint widths are narrow and of uniform width.

FIRE-RESISTANT JOINT SEALERS

General: Provide manufacturer's standard sealant and accessory materials with fire-resistance rating indicated which are identical to those of assemblies whose fire endurance has been determined by testing per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

Foamed-In-Place Fire-Stopping Sealant: Two-part, foamed-in-place, silicone sealant formulated for use as part of a through-penetration fire-stop system for filling openings around cables, conduit, pipes and similar penetrations through walls and floors.

One-Part Fire-Stopping Sealant: One part elastomeric sealant formulated for use as part of a through-penetration fire-stop system for sealing openings around cables, conduit, pipes and similar penetrations through walls and floors.
Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

Foamed-In-Place Fire-Stopping Sealant:
"Dow Corning Fire Stop Foam"; Dow Corning Corp.
"Pensil 851"; General Electric Co.

One-Part Fire-Stopping Sealant:
"Dow Corning Fire Stop Sealant"; Dow Corning Corp.
"3M Fire Barrier Caulk CP-25; Electrical Products Div./3M.

ACCESSORIES
Primer: Non-staining type, recommended by sealant manufacturer to suit application.

Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

EXAMINATION
Verify that substrate surfaces are ready to receive work.
Verify that joint backing and release tapes are compatible with sealant.

PREPARATION
Remove loose materials and foreign matter which might impair adhesion of sealant.
Clean and prime joints in accordance with manufacturer's instructions.
Perform preparation in accordance with manufacturer's instructions and ASTM C 1193.
Protect elements surrounding the work of this section from damage or disfigurement.

INSTALLATION
Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
Perform installation in accordance with ASTM C 1193.

Special Note: All penetrations through all walls by any pipe, wire, duct, or any item must have the annular void around such item filled. Special attention to the spaces above dropped ceilings to the deck above.

Perform acoustical sealant application work in accordance with ASTM C 919.

Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
Width/depth ratio of 2:1.
Neck dimension no greater than 1/3 of the joint width.
Surface bond area on each side not less than 75 percent of joint width.
Install bond breaker where joint backing is not used.

Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

Tool joints concave, do not leave joints gun grade.

Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal all joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.

CLEANING

Clean adjacent soiled surfaces.

PROTECTION OF FINISHED WORK

Protect sealants until cured.

END OF SECTION
SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

RELATED DOCUMENTS
Applicable provisions of Division 1 shall govern work of this Section

SECTION INCLUDES
Expansion joint assemblies for:
• floor, at new doors threshold or openings where new addition connects to existing on both levels
• Roof, where new firewall is installed adjacent to existing parapet wall.

REFERENCES

SUBMITTALS
Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices, available colors and finish.
Samples: Submit two samples, illustrating profile, dimension, color, and finish selected.
Manufacturer's Installation Instructions: Indicate rough-in sizes; provide templates for cast-in or placed frames or anchors; required tolerances for item placement.

PART 2 PRODUCTS

MANUFACTURERS
Expansion Joint Cover Assemblies:
InPro Corporation, 801 Series www.inprocorp.com

FABRICATION
Joint Covers: Aluminum cover plate, aluminum frame construction, designed to permit plus or minus 50 percent joint movement with full recovery, flush mounted.
Back paint components in contact with cementitious materials.
Galvanize embedded ferrous metal anchors and fastening devices.
Shop assemble components and package with anchors and fittings.
Provide joint components in single length wherever practical. Minimize site splicing.

FINISHES
Floors: Mill finish.

PART 3 EXECUTION

EXAMINATION
Verify that joint preparation and affected dimensions are acceptable.

INSTALLATION
Install components and accessories in accordance with manufacturer's instructions.
Align work plumb and level, flush with adjacent surfaces.
Rigidly anchor to substrate to prevent misalignment.

PROTECTION OF FINISHED WORK
Do not permit traffic over unprotected floor joint surfaces.
Provide strippable coating to protect finish surface.

END OF SECTION
GENERAL
Applicable provisions of Division 1 shall govern work under this Section.

WORK INCLUDED
Hollow metal doors.
Hollow metal frames.

RELATED WORK
Section 08 2100 - Wood Doors
Section 08 7100 - Finish Hardware
Section 08 8000 - Glazing

STANDARDS
In addition to other specified requirements, comply with Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames" (SDI-100).

DELIVERY, STORAGE AND HANDLING
Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.
Inspect hollow metal work upon delivery for damage. Minor damage may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect/Engineer, otherwise, remove and replace damaged items as directed.
Store doors and frames at building site under cover. Place units on minimum 4" high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

SUBMITTALS
With manufacturer's standard details and specifications for steel doors and frames, submit shop drawings showing application to project, as required.

AVAILABLE MANUFACTURERS
Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
Ceco Corporation
Curries Manufacturing, Inc.
Fenestra Corporation
Steelcraft/Division American Standard Company
Republic Builders Products Corp./Subs. Republic Steel
Precision Metals, Inc.
FIRE-RATED ASSEMBLIES
Provide units that display appropriate UL or FM labels for fire-rating indicated.

MATERIALS
Steel doors and frames; hot-rolled, pickled and oiled per ASTM A 569 and A 568; cold-rolled per
ASTM A 366 and A 568.

Galvanized sheets, ASTM A 526 with ASTM A 525, G 60 zinc coating, mill phosphatized.

Doors

Interior doors: SDI-100, Grade II, heavy-duty, Model 1, minimum 18-gage faces.

Exterior doors: SDI-100, Grade III, extra heavy-duty, Model 2, 16-gages. Galvanized sheets,
insulated core. To have closed top and bottoms as integral part of door construction
or by adding inverted 16 gauge steel channels.

Glazed openings shall be factory cut. Stops for doors and to receive insulating glass shall be
providing with stops 3/4" deep.

Door edges shall be beveled 1/8' in 2" at lock and hinge edges.

Frames:

- Exterior Door Frames: 16 gage galvanized cold rolled steel welded.
- Interior Masonry Wall Door Frames: 16 gage welded cold rolled steel.
- Interior Gypsum Board Wall Door Frames: 16 gage drywall knockdown frames unless with
  a sidelight then frame shall be welded.
- Glazed openings for insulated glass shall have 3/4" deep stops.
- Frames to receive 3 drilled type silencers on strike jambs of single-swing frames and on
  heads of double-swing frames.
- See drawings for wall thickness and details for frame widths before shop drawing
  preparation.
- Provide 26-ga. steel plaster guards or mortar boxes, welded to frame, at back of hardware
  cutouts where installed in concrete, masonry or plaster opening.
- Mullions and transom bars: Provide closed or tubular mullions and transom bars where
  indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding.
  Reinforce joints between frame members with concealed clip angles or sleeves same metal
  and thickness as frame.
- Steel frames shall be standard profile. See drawings for details. Reinforce all members to
  suit heights and widths as recommended by the manufacturer and required by Code.
  Fabricate steel frame units to be rigid, neat in appearance and free from defects, warp or
  buckle. Wherever practicable, fit and assemble units in manufacturers plant. Clearly
  identify work that cannot be factory-assembled before shipment to assure proper assembly at
project site. Weld units together neatly, grind smooth and prime coat ready for final field finish per painting Section 09900. Overall frame depth shall be standard 5-3/4” unless noted otherwise on Drawings.

ANCHORS AND ACCESSORIES
Manufacturer's standard units. Use galvanized items for units built into exterior walls, complying with ASTM A 153. Use screw type masonry anchors in existing masonry walls.

FABRICATION
Fabricate units to be rigid, neat in appearance, and free from defects, warp or buckle. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible.

Prepare steel doors and frames to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling and tapping, complying with ANSI A 115 "Specifications for Door and Frame Preparation for Hardware".

Reinforce units to receive surface-applied finish hardware to be field applied.

Locate finish hardware as indicated or, if not indicated, per DHI "Recommended Locations for Builder's Hardware".

Shop paint exposed surfaces of doors and frame units, including galvanized surfaces, using manufacturer's standard baked-on rust inhibitive primer.

INSTALLATION
Install hollow-metal units in accordance with manufacturer's instructions and final shop drawings. Fit doors to frames and floors with clearances specified in SDI-100. Provide a minimum of three wall anchors per jamb.

Install fire-rated units in accordance with NFPA Std. No. 80.

Finish hardware is specified in Section 08710.

Touch up prime coat immediately after installation. Sand smooth any rusted or damaged areas of prime coat and apply compatible touch up air drying primer.

* * * * * *
SECTION 08 21 00
WOOD DOORS

GENERAL
Applicable provisions of Division 1 shall govern work under this Section.

WORK INCLUDED
Wood doors.

RELATED WORK
Section 08 71 00 - Finish Hardware.
Section 08 80 00 - Glass and Glazing.
Section 08 11 00 - Steel Doors and Frames.
Section 09 90 00 - Painting.
Division 15 - HVAC Section

STANDARDS
Comply with requirements of ANSI/NWMA I.S. 1 and Section 1300 of AWI "Architectural Woodwork Quality Standards" except as otherwise indicated.

SUBMITTALS
In addition to product data, submit the following:

Shop Drawings indicates location, size, face materials, core construction, fire-ratings (if any), finishes, and elevations for each door required.

Samples for each type of door construction, face material and finish required.

Product warranty on door manufacturer's standard form, signed by Manufacturer, Installer and Contractor, agreeing to repair or replace defective doors as defined by referenced standards. Warranty shall be in effect during following periods of time after date of substantial completion.

Solid core flush interior doors: Life of Installation
Hollow core flush interior doors: Two Years

MANUFACTURERS
Subject to compliance with requirements, provide wood doors by one of the following:

Algoma Hardwoods Inc.
Eggers Industry
Graham Manufacturing Company
Weyerhauser Company
VT Industries
GENERAL WOOD DOOR PRODUCT REQUIREMENTS

Exposed surfaces: Same exposed surface material on both faces of each door except as otherwise indicated.

Grilles, where required, shall be A-J Manufacturing Company, Series 77A with wood stops. Frame 20 Ga. steel, blades 24 Ga. steel hemmed edges, counter sunk mounting holes, prime finish. Free area shall be 80% approximately. Do not install grilles if doors will be field finished. Install after doors are stained, sealed and varnished. Grilles to be factory painted to color selected by Architect.

Fire-rated doors: Labeled and listed with rating required by a testing and inspection organization acceptable to authority having jurisdiction.

Vision panels in wood doors shall have glazing set with Oak stops, finished to match door. In doors which are fire rated, glazing shall be set in U.L. listed 18 Ga. frames, thru bolted with a blank head one side, finish of Beige enamel, equal to Anemostat FGS-75.

INTERIOR SOLID CORE FLUSH DOORS FOR TRANSPARENT FINISH

Faces: Red oak, Plain Sliced
Grade: "A"
Construction: PC-5 particle Core

Note: Verify Door Styles door construction due to glass lite and grille cutouts to ensure warranty specified is not voided.

SOLID CORE DOORS RATED AND NON-RATED

Faces: 2 Ply plywood AWI Grade: Match faces and grade of non-rated doors in same area of building.

Core construction: Manufacturer's standard core construction required to provide fire-resistance rating indicated. Provide interior blocking required for securing door hardware without through bolting.

Edge construction: Manufacturer's standard laminated edge construction for improved screw-holding ability. Rails top and bottom 1-3/8" minimum. Stiles 1-3/8" minimum 2 ply hardwood. Edge to have veneer banding same as door face.

Job site finished doors: See Painting Section 09900 for requirements for finishing wood doors.

Prefit and premachine wood doors at factory. Coordinate with finish hardware and door frame requirements. Note: doors with existing frames shall be field prepared.

Reinforcement: Provide reinforcement on fire rated doors to eliminate through bolting of hardware to provide clearances to swing free.
INSTALLATION

Install doors to comply with manufacturer's instructions. To provide proper clearances and to swing free. Protect installed wood doors from damage until acceptance of the work.
SECTION 08 41 20
ALUMINUM FRAMED WINDOW GLAZING

RELATED DOCUMENTS
Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.

WORK INCLUDED
Aluminum thermal break frames fixed glazing.

RELATED WORK
Section 07 90 00 - Sealants.
Section 08 80 00 Glass and Glazing

SUBMITTALS
Submit shop drawings for windows to be used on this project. Information shall include full size details, anchors, and accessories required.

Submit color samples to Owner for selection. Colors to be selected from Dark, Medium or Light Bronze.

PRODUCT DELIVERY, STORAGE AND HANDLING
Store and handle windows in strict compliance with manufacturers instructions.

Protect material adequately against damage from the elements, construction activities and other hazards before, during, and after installation.

WARRANTY
Provide manufacturers written warranty against material defects in manufacture of sash, frames, doors, parts, thermal barrier and finish for a period of ten (10) years. If product is defective, it shall be repaired or replaced at no cost to the Owner during this warranty period.

MANUFACTURERS
One manufacturer shall be used for all aluminum frames. The drawings have been detailed around Kawneer products. If other manufacturers are used, the necessary adjustments shall be made to meet the intent of the drawings subject to Architect approval. Other manufacturers materials wishing to be used shall have prime contractor submit information and technical data to the Architect a minimum of ten (10) days before bid date for review and approval.

Approved Manufacturers

1) 451-T Series by Kawneer
2) S-403 Thermal Series by Efco
MATERIALS
2" x 4-1/2" thermally broken .080" thick extruded 6063-T5 or T6 Alloy. Aluminum framing to be equal to Kawneer 451T, thermal barrier frame. Glazing gaskets to be elastomeric extrusions. Vinyl gaskets are not acceptable. Glass to be 1" insulated glass. Fasteners shall be aluminum, stainless steel or plated steel. All exposed surfaces to be free of scratches, blemishes, etc., and shall be an Architectural Class 1 color anodic coating conforming with AA-M12C22A42/42.

FABRICATION
The framing systems shall provide for push glazing on all sides with no projecting stops. Nominal dimensions of 2"x4-1/2".

INSTALLATION
Install new framing accessories by experienced workman in accordance with the manufacturers installation instructions and approved shop drawings. Frames to be plumb, square and secured. All joints between framing and building structure shall be sealed in order to secure a watertight installation.

See Section 08 80 00 for new glazing.

All areas requiring sealants shall be properly tooled and excess sealants removed from adjoining surfaces.

At completion of work, clean all glass and aluminum surfaces. Adjust operating hardware to function properly.

Keep project site clean of all debris daily.

* * * * *
SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

A. RELATED DOCUMENTS

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

I. SECTION INCLUDES

A. Hardware for wood doors.
B. Hardware for hollow metal steel doors.
C. Hardware for fire-rated doors.
D. Electrically operated and controlled hardware.
E. Lock cylinders for doors for which hardware is specified in other sections.
F. Thresholds.
G. Weather-stripping, seals and door gaskets.

II. RELATED SECTIONS

A. Division 01 Section “Alternates” for alternates affecting this section.
B. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
C. Section 08 11 13 - Hollow Metal Doors and Frames.
D. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.
E. Division 26 sections for connections to electrical power system and for low-voltage wiring.
F. Division 28 sections for coordination with other components of electronic access control system

III. REFERENCES

B. BHMA A156.1 - American National Standard for Butts and Hinges; Builders Hardware Manufacturers Association, Inc.; 2000 (ANSI/BHMA A156.1).
C. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; Builders Hardware Manufacturers Association; 2003 (ANSI/BHMA A156.2).
D. BHMA A156.3 - American National Standard for Exit Devices; Builders Hardware Manufacturers Association; 2001 (ANSI/BHMA A156.3).
E. BHMA A156.4 - American National Standard for Door Controls - Closers; Builders Hardware Manufacturers Association, Inc.; 2000 (ANSI/BHMA A156.4).
F. BHMA A156.5 - American National Standard for Auxiliary Locks & Associated Products; Builders Hardware Manufacturers Association; 2001 (ANSI/BHMA A156.5).
IV. SUBMITTALS

A. Shop Drawings:

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

2. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts, electrical characteristics and connection requirements.

3. Submit keying schedule to Architect for approval after consulting with the Owner on their requirements.
4. Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute.

5. Submit shop drawings indicating products to be furnished on each door. Hardware supplier to provide all accessories required, whether specified or not, for a complete and operating hardware installation and operation.

Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.

6. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

   a) Wiring Diagrams: For power, signal, and control wiring and including:
      1. Details of interface of electrified door hardware and building safety and security systems.
      2. Schematic diagram of systems that interface with electrified door hardware.
      3. Point-to-point wiring.
      4. Risers.

   B. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

   C. Keys and Key Schedule:

   D. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.

   E. Use ANSI A156.28 “Recommended Practices for Keying Systems” as guideline for nomenclature, definitions, and approach for selecting optimal keying system.

   F. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.

   G. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.

   H. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.

      a) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

   I. Prepare key schedule by or under supervision of supplier, detailing Owner’s final keying instructions for locks.
J. Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

Warranty: Submit manufacturer’s warranty and ensure that forms have been completed in Owner’s name and registered with manufacturer.

V. QUALITY ASSURANCE

A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.

B. Where specific manufacturer’s product is named and accompanied by “No Substitute,” including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)

1. Where no additional products or manufacturers are listed in product category, requirements for “No Substitute” govern product selection.

C. Where products indicate “acceptable substitute” or “acceptable manufacturer”, provide product from specified manufacturers, subject to compliance with specified requirements and “Single Source Responsibility” requirements stated herein.

D. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

E. Warehousing Facilities: In Project's vicinity.

F. Scheduling Responsibility: Preparation of door hardware and keying schedules.

G. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer’s standard units in assemblies similar to those indicated for this Project.

H. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.

1. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

I. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.

J. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

K. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).

L. Can provide installation and technical data to Architect and other related subcontractors.

M. Can inspect and verify components are in working order upon completion of installation.
N. Capable of producing wiring diagrams.

O. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.

P. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

Q. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.

R. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

S. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.

T. Attendees: Owner, Contractor, Architect, Installer, Owner's security consultant, and Supplier’s Architectural Hardware Consultant.

U. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.

2. Preliminary key system schematic diagram.

3. Requirements for access control.

4. Address for delivery of keys.

V. Pre-installation Conference: Conduct conference at Project site

W. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

X. Inspect and discuss preparatory work performed by other trades.

Y. Inspect and discuss electrical roughing-in for electrified door hardware.

Z. Review sequence of operation for each type of electrified door hardware.

AA. Review required testing, inspecting, and certifying procedures.

BB. Coordination Conferences:

CC. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.

1. Attendees: Door hardware supplier, door hardware installer, Contractor.

2. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

DD. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner, Owner’s security consultant, Architect and Contractor.

2. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.
I. DELIVERY, STORAGE, AND PROTECTION

A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

II. COORDINATION

A. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.

B. Furnish templates for door and frame preparation.

C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

D. Coordinate Owner's keying requirements during the course of the Work. All locks to be keyed to Owner’s master key.

III. WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Years from date of Substantial Completion, for durations indicated.

1. Closers:
   a. Mechanical: 10 years.
   b. Electrified: 2 years.

2. Exit Devices:
   a. Mechanical: 3 years.
   b. Electrified: 1 year.

3. Locksets:
   a. Mechanical: 3 years.
   b. Electrified: 1 year.


5. Key Blanks: Lifetime

C. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

EXTRA MATERIALS

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

IV. MAINTENANCE PRODUCTS

Provide special wrenches and tools applicable to each different or special hardware component.

Provide maintenance tools and accessories supplied by hardware component manufacturer.
PART 2 – PRODUCTS

V. MANUFACTURERS

A. Subject to compliance with requirements, products which may be incorporated in the work include those of the following Acceptable Manufacturers. The first Acceptable Manufacturer’s name for each item is the manufacturer of the product used in the hardware sets.

B. The Owner requires use of certain products for their unique characteristics and particular project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings, Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: “No Substitute.” Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

C. Approval of manufacturers other than those listed shall be in accordance with QUALITY ASSURANCE article, herein.

D. Approval of products from manufacturers indicated as “Acceptable Manufacturer” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

E. Hinges and Pivots:
   1. Ives
   2. Hager Companies
   3. Stanley Hardware

F. Continuous Hinges:
   4. Hager Companies
   5. Select
   6. Zero

G. Push/Pulls:
   1. Ives
   2. Trimco
   3. Hiawatha, Inc.


I. Exit Devices: Non-Fire rated doors to have cylinder dogging device on exit device. Von Duprin. No Substitution per owner.

J. Closers: Parallel arm unless noted otherwise, plastic covers in spray finish to match other hardware. Closer arm to permit maximum opening allowed by construction.
   1. LCN. No substitution per owner.

K. Overhead Holders:
   1. Glynn-Johnson.
L. Weather-stripping and Seals:
   2. Reese Enterprises, Inc.
   3. NGP

M. Thresholds:
   2. NGP
   3. Reese Enterprises, Inc.

N. Stops:
   1. Ives
   2. Trimco
   3. Hiawatha

O. Kick Plates: 10” high, 16 gage less 2” door width.
   1. Ives
   2. Rockwood

P. Electric Strikes:
   1. Von Duprin

P. Miscellaneous Hardware Items:
   1. Provide products shown in hardware sets.

GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

VI. EXISTING MATERIALS

A. Where existing door hardware is indicated to be removed and reinstalled:
   1. Carefully remove door hardware and components.
   2. Clean, protect and store existing door hardware in accordance with storage and handling
      requirements specified herein.
   3. Reinstall in accordance with installation requirements for new door hardware.

VII. NEW MATERIALS

A. Provide products that comply with the following:
   1. Applicable provisions of Federal, State, and local codes.
   2. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings
      and Facilities.
   5. All Hardware on Fire-Rated Doors: Listed and classified by UL as suitable for the
      purpose specified and indicated.
   6. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door
      assemblies are required, provide door hardware that meets requirements of assemblies
      tested according to UL 1784 and installed in compliance with NFPA 105.
   7. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by
      testing agency acceptable to authorities having jurisdiction. Products Requiring
      Electrical Connection: Listed and classified by UL as suitable for the purpose specified
      and indicated.
8. Hardware supplier to provide all accessories required, whether specified or not, for a complete and operating hardware installation and operation. Hardware supplier to notify the Architect if any conflicts with hardware specified ten days before bids are due.

B. Finishes: Identified in schedule at end of section.

VIII. KEYING

A. Medeco key system cylinders provided by Owner and installed by Contractor under separate contract.

PART 3 - EXECUTION

IX. EXAMINATION

A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of the correct characteristics.

X. INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

D. Mounting heights for hardware from finished floor to center line of hardware item: As listed in Schedule, unless otherwise noted:

1. For steel doors and frames: Comply with DHI "Recommended Locations for Architectural Hardware for Steel Doors and Frames."

2. 

3. For steel doors and frames: See Section 08 11 13.

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

F. Wiring: Coordinate with Division 26, ELECTRICAL sections for:

1. Conduit, junction boxes and wire pulls.

2. Connections to and from power supplies to electrified hardware.

3. Connections to fire/smoke alarm system and smoke evacuation system.

4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.

5. Testing and labeling wires with Architect’s opening number.
G. THRESHOLDS SHALL BE SET IN A FULL BED OF BUTYL RUBBER OR POLYISOBUTYLENE MASTIC SEALANT.

XI. FIELD QUALITY CONTROL

A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

B. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

XII. ADJUSTING

A. Adjust hardware for smooth operation upon installation and one month after Owner’s occupancy.

XIII. DEMONSTRATION

A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training." PROTECTION OF FINISHED WORK

XIV. HARDWARE SCHEDULE

A. FINISHES AND MATERIALS (Unless Otherwise Noted) Editor’s Note: Confirm finishes

1. Locks and Latches: US26D
2. Dead Locks: US26D
3. Door Closers: Spray to Match US26D
4. Door Butts – nonferrous – for exterior, toilet, bath and other wet areas: Ferrous – Other Doors US26D
5. Door Stops and Holders: US26D
6. Miscellaneous Items: US26D
7. All Stainless Steel shall be Type 302 - 18-8.
8. Exit Devices: US26D
## HARDWARE SCHEDULE

### Hardware Group No. 01

Provide each PR door(s) with the following:

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
<th>Catalog Number</th>
<th>Finish</th>
<th>Mfr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CONTINUOUS HINGE</td>
<td>780-224HD</td>
<td>CLR</td>
<td>HAG</td>
</tr>
<tr>
<td>1</td>
<td>RIM EXIT DEVICE</td>
<td>CD 99 NL</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>RIM EXIT DEVICE</td>
<td>CD 99 DT</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>3</td>
<td>MEDECO CYLINDER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>REM. MULLION</td>
<td>KR 4954</td>
<td>SP28</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>MEDECO CYLINDER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>ELECTRIC STRIKE</td>
<td>6300</td>
<td>630</td>
<td>VON</td>
</tr>
<tr>
<td>2</td>
<td>CLOSER</td>
<td>4040XP EDA</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>2</td>
<td>OVERHEAD STOP</td>
<td>100S</td>
<td>630</td>
<td>GLY</td>
</tr>
<tr>
<td>1</td>
<td>GASKETING</td>
<td>160SA</td>
<td>AL</td>
<td>NGP</td>
</tr>
<tr>
<td>1</td>
<td>MULLION SEAL</td>
<td>5100N</td>
<td>BLK</td>
<td>NGP</td>
</tr>
<tr>
<td>2</td>
<td>DOOR SWEEP</td>
<td>200NA</td>
<td>AL</td>
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</tr>
<tr>
<td>1</td>
<td>THRESHOLD</td>
<td>8425</td>
<td>MIL</td>
<td>NGP</td>
</tr>
<tr>
<td>1</td>
<td>CARD READER</td>
<td>679-05HM</td>
<td>BLK</td>
<td>SCE</td>
</tr>
</tbody>
</table>

**OPERATIONAL DESCRIPTION:** DOOR NORMALLY CLOSED AND LOCKED AFTER HOURS. VALID CREDENTIAL ALLOWS ENTRY. DURING OPERATING HOURS, ELECTRIC STRIKES HELD RETRACTED THROUGH ACCESS CONTROL SYSTEM TO ALLOW FREE EGRESS IN BOTH DIRECTIONS. DOOR REMAINS LOCKED UPON LOSS OF POWER. INSIDE PUSH PAD ALWAYS FREE FOR EGRESS.

### Hardware Group No. 02

Provide each PR door(s) with the following:

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<tr>
<th>Qty</th>
<th>Description</th>
<th>Catalog Number</th>
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<tr>
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<td>CONTINUOUS HINGE</td>
<td>780-224HD</td>
<td>CLR</td>
<td>HAG</td>
</tr>
<tr>
<td>2</td>
<td>RIM EXIT DEVICE</td>
<td>CD 99 EO</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>2</td>
<td>MEDECO CYLINDER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>REM. MULLION</td>
<td>KR 4954</td>
<td>SP28</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>CYLINDER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CLOSER</td>
<td>4040XP EDA</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>2</td>
<td>OVERHEAD STOP</td>
<td>100S</td>
<td>630</td>
<td>GLY</td>
</tr>
<tr>
<td>1</td>
<td>GASKETING</td>
<td>160SA</td>
<td>AL</td>
<td>NGP</td>
</tr>
<tr>
<td>1</td>
<td>MULLION SEAL</td>
<td>5100N</td>
<td>BLK</td>
<td>NGP</td>
</tr>
<tr>
<td>2</td>
<td>DOOR SWEEP</td>
<td>200NA</td>
<td>AL</td>
<td>NGP</td>
</tr>
<tr>
<td>1</td>
<td>THRESHOLD</td>
<td>8425</td>
<td>MIL</td>
<td>NGP</td>
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Hardware Group No. 03

Provide each PR door(s) with the following:

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<td>CONTINUOUS HINGE</td>
<td>780-224HD</td>
<td>CLR</td>
<td>HAG</td>
</tr>
<tr>
<td>2</td>
<td>DUMMY BAR</td>
<td>330</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>2</td>
<td>DUMMY PULL</td>
<td>990 DT</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>2</td>
<td>CLOSER W/HOLD OPEN</td>
<td>4040XP HEDA</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>2</td>
<td>OVERHEAD STOP</td>
<td>100S</td>
<td>630</td>
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</table>

Hardware Group No. 04

Provide each PR door(s) with the following:

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<td>CONTINUOUS HINGE</td>
<td>780-224HD</td>
<td>CLR</td>
<td>HAG</td>
</tr>
<tr>
<td>1</td>
<td>RIM EXIT DEVICE CD 99 EO</td>
<td>626</td>
<td>VON</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MEDECO CYLINDER BY OTHERS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CLOSER 4040XP EDA</td>
<td>689</td>
<td>LCN</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>OVERHEAD STOP</td>
<td>100S</td>
<td>630</td>
<td>GLY</td>
</tr>
<tr>
<td>1</td>
<td>GASKETING</td>
<td>160SA</td>
<td>AL</td>
<td>NGP</td>
</tr>
<tr>
<td>1</td>
<td>DOOR SWEEP</td>
<td>200NA</td>
<td>AL</td>
<td>NGP</td>
</tr>
<tr>
<td>1</td>
<td>THRESHOLD</td>
<td>8425</td>
<td>MIL</td>
<td>NGP</td>
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</table>

Hardware Group No. 05

Provide each SGL door(s) with the following:

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<tr>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>CONTINUOUS HINGE</td>
<td>780-224HD x EPT PREP</td>
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</tr>
<tr>
<td>1</td>
<td>POWER TRANSFER</td>
<td>EPT-10</td>
<td>SP28</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>RIM EXIT DEVICE</td>
<td>99 L-F x E996</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>MEDECO CYLINDER</td>
<td>BY OTHERS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>4040XP</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>WALL STOP</td>
<td>WS407</td>
<td>630</td>
<td>IVE</td>
</tr>
</tbody>
</table>

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED FROM STAIR SIDE. KEY OVERRIDE ALLOWS ENTRY. DOOR AUTOMATICALLY UNLOCKS UPON SIGNAL FROM FIRE ALARM SYSTEM OR LOSS OF POWER. INSIDE PUSH PAD ALWAYS FREE FOR EGRESS.

Hardware Group No. 06

Provide each SGL door(s) with the following:
<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
<th>Catalog Number</th>
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<th>Mfr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CONTINUOUS HINGE</td>
<td>780-224HD</td>
<td>CLR</td>
<td>HAG</td>
</tr>
<tr>
<td>1</td>
<td>STOREROOM LOCK</td>
<td>ND80LD RHO</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>MEDECO CYLINDER</td>
<td>BY OTHERS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>4040XP</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>OVERHEAD STOP</td>
<td>410S</td>
<td>630</td>
<td>GLY</td>
</tr>
<tr>
<td>1</td>
<td>GASKETING</td>
<td>5050</td>
<td>BLK</td>
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Hardware Group No. 07

Provide each SGL door(s) with the following:

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
<th>Catalog Number</th>
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<th>Mfr</th>
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</thead>
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<td>780-224HD</td>
<td>CLR</td>
<td>HAG</td>
</tr>
<tr>
<td>1</td>
<td>CLASSROOM LOCK</td>
<td>ND70LD RHO</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>MEDECO CYLINDER</td>
<td>BY OTHERS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>WALL STOP</td>
<td>WS407</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>KICK PLATE</td>
<td>8400 10&quot; X 2&quot; LDW B-CS</td>
<td>630</td>
<td>IVE</td>
</tr>
</tbody>
</table>

Hardware Group No. 08

Provide each SGL door(s) with the following:

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
<th>Catalog Number</th>
<th>Finish</th>
<th>Mfr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CONTINUOUS HINGE</td>
<td>780-224HD</td>
<td>CLR</td>
<td>HAG</td>
</tr>
<tr>
<td>1</td>
<td>PULL PLATE</td>
<td>8305 10&quot; (4&quot; X 16&quot;)</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>4040XP</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>KICK PLATE</td>
<td>8400 10&quot; X 2&quot; LDW B-CS</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>WALL STOP</td>
<td>WS407</td>
<td>630</td>
<td>IVE</td>
</tr>
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</table>

Hardware Group No. 09

Provide each SGL door(s) with the following:

<table>
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<tr>
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<th>Description</th>
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<th>Mfr</th>
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<tr>
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<td>CONTINUOUS HINGE</td>
<td>780-224HD</td>
<td>CLR</td>
<td>HAG</td>
</tr>
<tr>
<td>1</td>
<td>PULL PLATE</td>
<td>8200 (4&quot; X 16&quot;)</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>4040XP</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>KICK PLATE</td>
<td>8400 10&quot; X 2&quot; LDW B-CS</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>WALL STOP</td>
<td>WS407</td>
<td>630</td>
<td>IVE</td>
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Hardware Group No. 10

Provide each PR door(s) with the following:

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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1 EA   GASKETING  160SA     AL   NGP
1 EA   DOOR SWEEP  200NA     AL   NGP
1 EA   THRESHOLD  8425       MIL  NGP

REMAINDER OF EXISTING HARDWARE TO BE RE-USED.

Hardware Group No. 11

Provide each SGL door(s) with the following:

<table>
<thead>
<tr>
<th>Qty</th>
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<th>Catalog Number</th>
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<th>Mfr</th>
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<tbody>
<tr>
<td>1</td>
<td>CONTINUOUS HINGE</td>
<td>780-224HD x EPT PREP</td>
<td>CLR</td>
<td>HAG</td>
</tr>
<tr>
<td>1</td>
<td>POWER TRANSFER</td>
<td>EPT-10</td>
<td>SP28</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>RIM EXIT DEVICE</td>
<td>99 L-BE-F x 99-ALK</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>MEDECO CYLINDER</td>
<td>AS REQUIRED</td>
<td>626</td>
<td>MED</td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>4040XP</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>WALL STOP</td>
<td>WS407</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>GASKETING</td>
<td>5050 BLK</td>
<td>BLK</td>
<td>NGP</td>
</tr>
<tr>
<td>1</td>
<td>DOOR CONTACT</td>
<td>679-05HM</td>
<td>BLK</td>
<td>SCE</td>
</tr>
<tr>
<td>1</td>
<td>CARD READER</td>
<td>BY OTHERS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LATCHED. VALID CREDENTIAL ALLOWS EGRESS WITHOUT ALARM. INSIDE PUSH PAD ALWAYS FREE FOR EGRESS.

Hardware Group No. 12

Provide each SGL door(s) with the following:

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
<th>Catalog Number</th>
<th>Finish</th>
<th>Mfr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CONTINUOUS HINGE</td>
<td>780-224HD</td>
<td>CLR</td>
<td>HAG</td>
</tr>
<tr>
<td>1</td>
<td>RIM EXIT DEVICE</td>
<td>CD 99 L-NL</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>2</td>
<td>MEDECO CYLINDER</td>
<td>AS REQUIRED</td>
<td>626</td>
<td>MED</td>
</tr>
<tr>
<td>1</td>
<td>ELECTRIC STRIKE</td>
<td>6300</td>
<td>630</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>4040XP</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>WALL STOP</td>
<td>WS407</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>DOOR CONTACT</td>
<td>679-05HM</td>
<td>BLK</td>
<td>SCE</td>
</tr>
<tr>
<td>1</td>
<td>CARD READER</td>
<td>BY OTHERS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL ALLOWS ENTRY. DOOR REMAINS LOCKED UPON LOSS OF POWER. INSIDE PUSH PAD ALWAYS FREE FOR EGRESS.

Hardware Group No. 13
Provide each SGL door(s) with the following:

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
<th>Catalog Number</th>
<th>Finish</th>
<th>Mfr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CONTINUOUS HINGE</td>
<td>780-224HD</td>
<td>CLR</td>
<td>HAG</td>
</tr>
<tr>
<td>1</td>
<td>RIM EXIT DEVICE</td>
<td>99 L-BE-F</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>4040XP</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>KICK PLATE</td>
<td>8400 10&quot; X 2&quot; LDW B-CS</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>WALL STOP</td>
<td>WS407</td>
<td>630</td>
<td>IVE</td>
</tr>
</tbody>
</table>

Hardware Group No. 14

Provide each SGL door(s) with the following:

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
<th>Catalog Number</th>
<th>Finish</th>
<th>Mfr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CONTINUOUS HINGE</td>
<td>780-224HD</td>
<td>CLR</td>
<td>HAG</td>
</tr>
<tr>
<td>1</td>
<td>STOREROOM LOCK</td>
<td>ND80LD RHO</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>MEDECO CYLINDER</td>
<td>BY OTHERS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>4040XP</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>WALL STOP</td>
<td>WS407</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>KICK PLATE</td>
<td>8400 10&quot; X 2&quot; LDW B-CS</td>
<td>630</td>
<td>IVE</td>
</tr>
</tbody>
</table>

Hardware Group No. 15

Provide each SGL door(s) with the following:

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
<th>Catalog Number</th>
<th>Finish</th>
<th>Mfr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CONTINUOUS HINGE</td>
<td>780-224HD</td>
<td>CLR</td>
<td>HAG</td>
</tr>
<tr>
<td>1</td>
<td>CLASSROOM LOCK</td>
<td>ND70LD RHO</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>MEDECO CYLINDER</td>
<td>BY OTHERS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>WALL STOP</td>
<td>WS407</td>
<td>630</td>
<td>IVE</td>
</tr>
</tbody>
</table>

FIELD VERIFY EXISTING CONDITIONS TO DETERMINE NEW HARDWARE COMPATIBILITY PRIOR TO ORDERING.

END OF SECTION
SECTION 08 80 00
GLASS AND GLAZING

GENERAL
Applicable provisions of Division 1 shall govern work under this Section.

WORK INCLUDED
Furnish and install glazing in hollow metal doors and frames and in wood doors.
Furnish and install glazing in borrowed lights and doors.
Furnish Glass in

RELATED WORK
Section 08 11 00 - Steel Doors and Frames
Section 08 21 00 - Wood Doors
Section 10 83 00 - Mirror Units

SPECIFIED WARRANTY
Provide a ten year written warranty for the sealed insulating glass with a glass replacement service policy by Installer. If seal fails within warranty period, replacement will be provided at no cost to Owner, including removing and replacing hardware as well as repainting if required.

GENERAL
Safety glazing standard: Comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.
Insulating glass certification program: Provide insulating glass units complying with requirements indicated which are permanently marked with certification label of the following inspecting and testing agency:
Insulating Glass Certification Council
Associated Laboratories, Inc.
Preconstruction sealant-substrate tests: Submit glass and glazing substrate materials to manufacturer of glazing sealants for testing to determine if primers are required and for sealant compatibility.

Submittals: In addition to product data submit the following:
1) Samples of each glass indicated, except for clear single pane units; and of each type of sealant
exposed to view.

2) Certificates of compliance from glass and glazing materials manufacturers.

GLASS MANUFACTURERS

Subject to compliance with requirements, provide products by one of the following, but not limited to:

Ford Glass Division
Libbey-Owens-Ford Company
PPG Industries Inc.
Viraccon, Inc.

SIZES

Fabricate glass of thicknesses indicated and to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer.

PRIMARY GLASS PRODUCTS

Comply with ASTM C 1036 for the following:

Clear Float Glass: Type I, Class 1, Quality q3.

Tinted Float Glass: Type I, Class 2, quality q3: of manufacturer's standard tint and with visible light transmittance and SHGC solar heat gain coefficient indicated, respectively, below:

Green: 36%, 0.21

UNCOATED HEAT-TREATED GLASS PRODUCTS

Comply with ASTM C 1048 and with manufacturing process indicated for the following:

Clear tempered float glass: Kind FT, Condition A, Type I, Class 1, Quality q3.

Tinted Tempered Float Glass: Grade B, Style I, Type I, quality q3, Class 2, and as follows: Match tint and performance characteristics specified for tinted float glass.

Manufacturing process: Vertical (tong-held) or horizontal (roller hearth), except horizontal where "tongless" is indicated.

SEALED INSULATING GLASS UNITS, GENERAL

Comply with requirements of ASTM E 774 for Class A units and the following:

For properties of individual glass panes making up units, refer to product requirements specified elsewhere in this section applicable to types, classes, kinds and conditions of glass products indicated.

Provide heat-treated panes of kind and at locations indicated and as recommended by glass
Sealed insulating glass units, general: Preassembled units with organically sealed panes of glass enclosing a hermetically sealed dehydrated air space and complying with requirements indicated.

DOORS
Provide full tempered glass in both lites of insulated glass for all doors specified in other sections.

Sealing system: Manufacturer's Standard
Spacer material: Manufacturer's Standard Metal

EXTERIOR GLASS IN TRANSOMS
For all exterior hollow metal frames - 1" insulated glass unit consisting of exterior lite of 1/4" float, 1/2" airspace, interior lite of 1/4" clear float glass. Low-E. All glass above 7'-0" height does not need to be tempered glass.

EXTERIOR GLASS-DOORS & FRAMES
For all exterior doors and frames - 1" insulated glass unit consisting of exterior lite of 1/4" tempered float glass, 1/2" air space and interior lite of 1/4" clear tempered float. Low-E

EXTERIOR GLASS- WINDOWS
Basis of Design: 1" insulated glass unit consisting of PPG Glass: Outdoor Lite: 6mm (1/4’’) Solarban R100 (2) on Solexia --Airspace: 1/2” (12.7 mm) -- Indoor Lite: 6mm (1’4’’) Clear
Tinted Sealed Insulating Glass Units: Units composed of tinted float glass for exterior pane, clear float glass for interior pane. Low-E

GLAZING SEALANT
Comply with sealant and glass manufacturers for selection of glass sealants which suit project application and installation conditions and which are compatible with surfaces contacted. Provide color of exposed sealants indicated or as selected by Architect.

1-part polysulfide glazing sealant: ASTM C 920, Type M, Grade NS, Class 25, Uses NT, G, A, and, as applicable, O. (Use for exterior glazing of wood and metal frames).

Preformed butyl-polyisobutylene glazing tape: AAMA 804.1, with or without continuous spacer rod as recommended by manufacturers of tape and glass for application indicated. (Use for interior glazing of wood and metal frames).

Cleaners, primers and sealers: Type recommended by manufacturer of sealants/gaskets.
Blocks and spacers: Neoprene, EPDM or silicone as required for compatibility with glazing sealants; of 80 to 90 Shore A hardness for setting blocks and, for spacers and edge blocks, of hardness recommended by glass and sealant manufacturer for application indicated.

Compressible filler rods: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, 5-10 psi compression strength for 25 percent compression.

GLASS INSTALLATION (GLAZING)
General: Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and gaskets, to achieve airtight and watertight performance, and to minimize breakage.

Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.

Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

Protect glass from contact with contaminating substances resulting from construction operations; remove any such substances by method approved by glass manufacturer.

Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

* * * * * *
SECTION 09 25 00
GYPSUM DRYWALL

GENERAL
Applicable provisions of Division 1 shall govern work under this Section.

WORK INCLUDED
Furnish and install metal studs and furring for gypsum board.
Furnish and install gypsum board.
Furnish and install sound attenuation blankets.

RELATED WORK
Section 04 20 00 - Unit Masonry
Section 06 10 00 - Rough Carpentry
Section 07 90 00 - Caulking
Section 09 90 00 - Painting

GENERAL
Gypsum board standard: ASTM C 840
Metal support standard: ASTM C 754
Acceptable manufacturers: Available Manufacturers: Subject to compliance with
requirements, manufacturers offering products which may be incorporated in the work include, but
are not limited, the following:

American Gypsum Company
Flintkote Products, Genstar Building Materials Company
Georgia-Pacific Company
Gold Bond Building Products Div., National Gypsum Company
United States Gypsum Company

Fire-resistance ratings: Provide gypsum drywall work with ratings indicated and conforming to
assemblies tested and listed by recognized authorities.

TEXTURE FINISH MATERIALS
Note that all gypsum board surfaces shall receive a spray on texture finish. Gypsum Wallboard
Texture Finish: This contractor shall apply an unaggregated spray on texture finish to all exposed
gypsum board surfaces. The contractor shall provide samples prepared in advance with the specified
materials, which, when approved by the Owner, shall be the standards of finish to be provided on
this project. Before applying, prepare surfaces as required in product directions. The base surface
must be sound, firm and dry, clean and free of dust, dirt, grease or other foreign material. Drywall
installer shall tape joints and provide three coat process of joint compound and sanding between
coats, sponge off joints and corners to remove dust and shall provide a spray on splatter finish to
produce an unaggregate mottle finish with good concealment of gypsum board joints and light to
medium textures.
WALL/PARTITION SUPPORT MATERIALS

Studs and Runners: ASTM C645, the following designations come from U.S.G. Company. ST 25 gauge is a 3-5/8" steel stud spaced 16" o.c. used for all interior non-load bearing partitions. Note: Plans, section and details may call these 3-1/2". Contractor shall make allowances in layout for this fractional difference in dimension strings. For all other metal studs shown on plans, provide sizes indicated x 22 gauge.

Steel rigid furring channels: ASTM C 645, 0.0179 inch (25 gauge) base metal thickness, hat-shaped, 1/2" deep. Where shown as "Resilient", provide manufacturers special type designed to reduce sound transmission.

See “WALL TYPES” on drawings for gauges of metal studs and depth of studs required per U.L. Designs listed for fire walls.

SUSPENDED GYPSUM BOARD CEILING

To consist of cold rolled steel carrying channels 2" deep, .0598 thick metal, 7/16" wide flanges. Furring channels shall be 3/4 inch deep. Wire for hangers and ties shall be zinc coated, soft, per ASTM A641. Secure to steel joists so that it is capable of sustaining a load equal to three times that of the ceiling construction. Carrying channels to be installed at 4'-0" o.c. and furring channels at 16" o.c.

DRYWALL MATERIALS


MISCELLANEOUS MATERIALS

Trim Accessories: Provide manufacturers standard metal trim accessories of the beaded type with face flanges for concealment in joint compound except where semi-finishing or exposed type is indicated. Provide corner beads, L-type edge trim beads, U-type trim beads, special L-kerf-type edge trim-beads and one piece control beads to finish off all drywall situations where drywall abuts any other material or creates and exposed edge. J-type edge trim is not allowed.

Laminating adhesives: Product recommended by gypsum board manufacturer.

Gypsum board fasteners: Type recommended by gypsum board manufacturer, except as otherwise indicated.

Acoustical sealant: As recommended by gypsum board manufacturer.

Sound attenuation blankets: Semi-rigid mineral fiber without membrane, FSHH-I-558B, Type I, 3" thicknesses required in walls and on ceilings shown. Equal to "Thermafiber" sound attenuation batts by United States Gypsum or "FBX Sound Control Fire Blankets" as
manufactured by Fibrex, Aurora, Illinois.

Joint tape: ASTM C 475, paper reinforcing tape.

Joint compound: ASTM C 475, of the type indicated.

Provide vinyl-type powder for interior work.

Provide ready-mixed vinyl-type for interior work.

Provide a single multi-purpose compound for 3 courses of compound application.

Provide water-resistant type manufactured by United States Gypsum Co. for use with water-resistant backing board.

WALL/PARTITION SUPPORT SYSTEM
Install steel studs with bottom and top runner tracks anchored to substrates. Isolate system from building structure to prevent transfer of loading and deflections into metal support system, both vertically and horizontally.

Frame door and other openings with studs and runners and gage, number and arrangement to comply with manufacturer's recommendations for size of opening, weight of doors and height and stud size, unless otherwise indicated.

Install supplementary framing, runners, furring, blocking and bracing at openings and terminations in gypsum drywall and where required for support of other work which cannot be adequately supported on gypsum board alone.

DRYWALL INSTALLATION AND FINISHING
Install gypsum boards in lengths and directions which will minimize number of end joints, and avoid end joints in central area of ceilings. Install walls and partitions with exposed gypsum boards vertical, with joints offset on opposite side of partitions. Otherwise, install boards with edges perpendicular to supports, with end joints staggered over supports, except where recommended in a different arrangement by manufacturer.

Form control joints with 1/2" space between boards. Install acoustical sealant at base of space, and apply trim accessory at face. 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.

Acoustical Sealant: Where work is indicated as "sound retarding" or shown with an STC rating, apply acoustical sealant as recommended by manufacturer. Sealant to be placed between gypsum board and adjacent surfaces around perimeter of wall and around all penetrations through wall.
Isolate drywall work from abutting structural and masonry work; provide edge trim and acoustical sealant as recommended by manufacturer.

Install sound attenuation blankets where indicated, without gaps; and support where necessary to prevent movement or dislocation.

Screw gypsum board to wood supports and metal supports.

Laminate face layer to backing board layer where double-layer work is indicated or required to make up indicated thickness.

Direct bonding: Comply with manufacturers recommendations where gypsum board is indicated to be directly bonded to substrate.

Do not bridge building expansion joints. Leave space of the width indicated between boards, and trim both edges for installation of sealant or gasket.

Drywall finishing: Except as otherwise indicated, apply joint tape and joint compound at joints (both directions) between gypsum boards. Apply compound at accessory flanges, penetrations, fasteners heads and surface defects.

Install compound in 3 coats (plus prefill of cracks where recommended by manufacturer); sand after last 2 coats.

Treat joints, fastener heads, cut edges and penetrations in water-resistant backing board using water-resistant joint compound to comply with water-resistant joint compound manufacturers directions.

Apply a texture finish to all drywall surfaces. Furnish Architect with different extures for selection. Remove any texture droppings or overspray from adjacent door frames, walls or other adjoining construction.

* * * * *
SECTION 09 30 00
TILE

GENERAL
Applicable provisions of Division 1 shall govern work under this Section.

WORK INCLUDED
Furnish and install porcelain tile flooring and base. Furnish and install ceramic wall tile and flooring.

RELATED WORK
Section 03 31 00 - Concrete Subfloor
Section 04 20 00 - Masonry Backup
Section 07 90 00 - Sealants
Section 09 25 00 - Metal Studs Backup

SUBMITTALS
Samples for initial selection purposes: Submit manufacturer's color charts consisting of actual tiles or sections of tile showing full range of colors, textures and patterns available for each type of tile indicated. Include samples of grout and accessories involving color selection.

STANDARDS
Mortar and grout materials and installation standards of the American National Standards Institute (ANSI) and Standard Specification for Ceramic Tile ANSI A137.1 apply to the work, except as otherwise indicated. Provide manufacturer's Master Grade Certificate.

COLORS, TEXTURES AND PATTERNS
As selected by Architect from manufacturer's standards.

SIZES AND THICKNESSES
As indicated or, if not indicated, as selected by Architect from manufacturer's standard sizes and thicknesses.

PROJECT CONDITIONS:
Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide build up.

Maintain temperatures at not less than 50 degrees F. (10 degrees C.) in tiled areas during installation and for seven days after completion, unless higher temperatures required by referenced installation standard or manufacturers instructions.
ACCEPTABLE MANUFACTURERS

Available manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

- Unglazed Porcelain Tile
- Crossville Ceramics
- Dal-Tile
- Graniti Fiandre
- Latex Portland Cement Grout:
  - Latricrete International, Inc.
  - The Upco Company
- Tile Cleaners:
  - Hillyard Chemical Company

PRODUCTS, GENERAL

ANSI Standard for quarry tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types and grades of tile indicated.

Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.

ANSI Standard for tile installation materials: Comply with ANSI standard referenced with installation products and materials indicated.

Colors, Textures and Patterns: For tile and other products requiring selection of colors, surface textures or other appearance characteristics, provide products to match characteristics indicated or, if not otherwise indicated as selected by Architect from manufacturer's standards.

Provide tile trim and accessories which match color and finish of adjoining flat tile.

TILE PRODUCTS

Trim units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:

1) Size: As indicated, coordinated with sizes and coursing of adjoining flat tile, where applicable.

Shapes: As follows, selected from manufacturer's standard shapes:
- Base for Thinset Mortar Installations: Straight.
- 4) External Corners for Thinset Installations: Surface bullnose.

Internal Corners: Field-butted square corners, except use internal cove and cap angle pieces
designed to member with stretcher shapes.

Type: Porcelain units with water absorption not exceeding 0.5%.

Trim shapes: As required for complete installation of same material, size, color and finish of field tile. Provide round top where there is no wall tile above.

Crack Isolation Sheet: Nobleseal CIS composite of CPE with high strength non-woven fabric laminated to both sides. Nominal thickness .030" x 3' wide minimum as manufactured by Noble Company: 1/800-878-5788.

Unglazed porcelain tile shall be of standard grade quality as manufactured by Crossville Ceramics or equal, and shall conform to requirements of ANSI A137.1-1980.

Type: Unglazed, porcelain tile shall be unpolished.

Size: Unglazed porcelain tile shall be manufactured to specific size after firing and shall be 12x12x5/16. Base: 6x8 coved.

Color: Unglazed porcelain tile shall be furnished in manufacturers standards. Accent colors to be Group 2 or 3.

Water absorption shall be .1% maximum per ASTM C373. Coefficient of friction of unpolished shall be greater than .60. Per ASTM C1028.

SETTING MATERIALS

Thin-Set Portland Cement Mortar: Where thin-set portland cement mortar applications are indicated, use the following unless otherwise required.

1) Latex-Portland cement mortar, ANSI A108.5 or ANSI A118.4.


GROUT

Grout to be a Latex Portland cement per ANSI A118.6 compatible with Latex Portland Cement mortar.

Grouting: Use commercial cement grout for wall joints. Use a 1-Part Portland Cement, 1-Part fine sand mixture for for grouting floors, unless otherwise indicated.

Grout Color: Porcelain Tile - Colored (to be selected) out of Group 1, 2 or 3 to match tile.

INSPECTION

Examine surfaces to receive tile work and conditions under which tile will be installed. Do not proceed with tile work until surfaces and conditions comply with requirements indicated in referenced tile installation standard.

Provide latex filler for level as required where new tile floor is scheduled per room schedule.
ANSI Tile Installation Standard: Comply with applicable parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile".

INSTALLATION, GENERAL

TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods indicated or, if not otherwise indicated, as applicable to installation conditions shown.

Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are same size. Layout tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise shown.

Grout tile to comply with referenced installation standards, using grout materials indicated. Grout joints shall be full flush joints with tile.

Provide metal edge strips where exposed edge of ceramic tile flooring is to meet carpet or other resilient floor covering.

Report all unacceptable surfaces to the Architect and do not tile such surfaces until they are levelled enough to meet above requirements.

Before tiling, all surfaces must be free of curing compounds, oil, grease, wax and dust.

FLOOR INSTALLATION METHODS

Install tile to comply with requirements indicated below for setting bed method, TCA installation method related to type of subfloor construction and grout type.

Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are same size. Layout tile work and center tile fields in both directions in each space on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise shown.

Crack isolation: At sawcut control joints in concrete slabs, install crack isolation sheet over joint for a width of three (3) tile minimum. Install per manufacturers instructions.

Floor Tile: Install tile to comply with requirements indicated below for setting bed method, TCA installation method related to type of subfloor construction and grout type:

Thin-Set Portland Cement Mortar: ANSI A108.5
Concrete Subfloor, Interior: TCAF113-93
Grout: ANSI A118.6
WALL TILE INSTALLATION METHODS
Install types of tile designated for wall application to comply with requirements indicated below for setting bed methods, TCA installation methods related to subsurface wall conditions and grout types:

Latex-Portland Cement Mortar: ANSI 118.4
Thin-Set Portland Cement Mortar: ANSI A108.4
Metal studs, Interior: TCA W243-97
Masonry Walls, Interior: TCAW202-97
Grout: Latex-Portland Cement A118.6

ACCEPTABILITY OF SURFACES
Before tiling, variations of surface to be tiled should fall within maximum variations shown below:

<table>
<thead>
<tr>
<th>Walls</th>
<th>Floors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>1/8&quot;</td>
</tr>
<tr>
<td>in 8'</td>
<td>in 10'</td>
</tr>
</tbody>
</table>

Report all unacceptable surfaces to the Architect and do not tile such surfaces until they are levelled enough to meet above requirements.

Before tiling, all surfaces must be free of curing compounds, oil, grease, wax and dust.

CLEANING AND PROTECTION
Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

Unglazed tile may be cleaned with acid solutions only when permitted by 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 surface with clean water before and after cleaning.

Finished tile work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile work.

One-part mildew-resistant silicone sealants: ASTM C 920, Type S, Grade NS, Class 25, Uses NT, G, A and O (for use in joints in non-traffic areas).

Multi-part urethane sealants: ASTM C 920, Type M, Grade P, Class 25, Uses T, M, A and O (for use in joints subject to pedestrian traffic).

Metal edge strips: Stainless steel or zinc alloy, 1/8" wide at top edge. Provide at exposed edge of tile meeting carpet, wood, other unfinished floor areas, or resilient flooring unless otherwise indicated.
Expansion, control, contractors and isolation joints: As indicated. Sealing tile joints is work of this section.

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

Prohibit foot and wheel traffic from using tiled floors for at least 7 days after grouting is completed.

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

* * * * * *
Applicable provisions of Division 1 shall govern all work under this section.

SECTION INCLUDES
Suspended metal grid ceiling system.
Acoustical units.

RELATED SECTIONS
Division 15 - Air Outlets/Grilles/Diffusers.
Division 16 - Light Fixtures.

REFERENCES

SUBMITTALS
Product Data: Provide data on suspension system components.
Samples: Submit two samples 12 x 12 inch in size illustrating material and finish of acoustical units.
Samples: Submit two samples each, 12 inches long, of suspension system main runner.
Manufacturer's Installation Instructions: Indicate special procedures.

QUALITY ASSURANCE
Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

ENVIRONMENTAL REQUIREMENTS
Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PROJECT CONDITIONS
Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
Install acoustical units after interior wet work is dry.
EXTRA MATERIALS

Provide 2 percent of total acoustical unit area of each type of acoustical unit for Owner's use in maintenance of project.

PART 2 - PRODUCTS

ACOUSTICAL UNITS

Manufacturers: This specification is based upon:

Armstrong World Industries, Inc. or Celotex

Acoustical Tile Type SACT-1:

Size: 24 x 24 inches.
Thickness: 5/8 inches.
Composition: Wet formed mineral fiber, 90% humidity rated.
Light Reflectance: 85 percent, determined as specified in ASTM E 1264.
Ceiling Attenuation Class (CAC): 33, determined as specified in ASTM E 1264.
Edge: Square.
Surface Color: White.
Surface Pattern: Medium, non-directional, fine fissured.
Suspension System: Exposed grid.

S.G.B.T. Ceiling Tile: 2 mil vinyl faced gypsum board.

Size: 24 x 24 inches
Thickness 1/2 inches
Composition: Gypsum Board
Light Reflectance: 77 percent, determined as specified in ASTM E 1264.
Ceiling Attenuation Class (CAC): 45-49, determined as specified in ASTM E 1264.
Edge: Square
Surface Color: White
Surface Pattern: Stipple Pattern
Suspension System: Exposed grid.

SUSPENSION SYSTEM(S)

Manufacturers:

Same as for acoustical units.

Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

Exposed Steel Suspension System for Type SACT-1, Ceiling: Formed steel, commercial quality cold rolled; intermediate-duty.

Profile: Tee; 15/16 inch wide face.
Construction: Double web.
Finish: White painted.

Exposed Aluminum Suspension System for S.G.B.T. Tile: Extruded aluminum; intermediate-duty.

Profile: Tee; 15/16 inch wide face.
Finish: White painted.
ACCESSORIES
Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

Perimeter Moldings: Same material and finish as grid.
- At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

Touch-up Paint: Type and color to match acoustical and grid units.

Hold-Down Clips to be installed in vestibules.

PART 3 - EXECUTION

EXAMINATION
Verify existing conditions before starting work.
Verify that layout of hangers will not interfere with other work.

INSTALLATION - SUSPENSION SYSTEM
Install suspension system in accordance with ASTM C 636, ASTM E 580, and manufacturer's instructions and as supplemented in this section.

Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

Locate system on room axis according to reflected plan.
Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.
Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
Do not eccentrically load system or induce rotation of runners.
Install grid members square with ends securely interlocked. Remove and replace dented, bent or kinked members.
Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions. Space anchors at 16” o.c. maximum and within 3” of the end.
- Use longest practical lengths.
- Overlap and rivet corners.
INSTALLATION - ACOUSTICAL UNITS

Install acoustical units in accordance with manufacturer's instructions.

Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

Lay directional patterned units with pattern parallel to longest room axis.

Fit border trim neatly against abutting surfaces.

Install units after above-ceiling work is complete.

Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

Cutting Acoustical Units:
- Cut to fit irregular grid and perimeter edge trim.
- Make field cut edges of same profile as factory edges.
- Double cut and field paint exposed reveal edges.
- All cuts shall result in neat and precise fit.

Where round obstructions occur, provide preformed closures to match perimeter molding.

Install hold-down clips on panels in vestibules.

ERECTION TOLERANCES

Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

CLEAN AND ADJUST

Clean exposed surfaces of acoustical ceilings and suspension system prior to substantial completion.

Comply with manufacturer’s instructions for cleaning and minor touch-up of finish damage. Remove and replace work which cannot be successfully cleaned and repaired so no evidence of damage is visible.

END OF SECTION
SECTION 09 65 00
RESILIENT FLOORING

GENERAL: Applicable provisions of Division 1 shall govern work under this Section.

WORK INCLUDED:
Furnish and install sheet vinyl flooring.
Furnish and install vinyl base.
Furnish and install stair treads and risers.

RELATED WORK:
Section 07 95 13 – Expansion Joint Cover Assemblies
Section 09 30 00 - Tile Work

SCOPE:
Provide all materials, labor, services, and incidentals necessary for the completion of this Section of the Work.

SUBMITTALS:
With manufacturer's data and installation instructions, submit the following:
Samples of each type, color and pattern of resilient flooring and accessories.
Maintenance instructions for each type of flooring.
Replacement material in the amount of five linear yards installed for sheet vinyl and minimum 2% of vinyl base installed.

COLORS AND PATTERNS:
As selected by Architect from manufacturer's standard colors and patterns.

ACCEPTABLE MANUFACTURERS:
Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
1) Wall Base:
   - Afco Rubber Corporation
   - Azrock Floor Products
   - Flexco Division, Textile Rubber Company, Inc.
   - Johnson Rubber Company, Flooring Accessories Division
   - Vinyl Plastics, Inc.
2) Sheet Vinyl: Tarkett
3) Rubber Safety Floor Tile and Stair Treads:
VINYL WALL BASE:
FS SS-W-40, Type II; 4" high; coved 1/8" gage; with matching stops and preformed corner units; standard top-set cove; unless otherwise indicated – See selections in Section 09 00 00.

EDGE STRIPS:
Minimum 1" wide metal with exposed fasteners.

SHEET VINYL FLOORING:
Basis of design is Johnsonite Standard IQ Granit, commercial homogeneous sheet vinyl flooring, nominal thickness of .080", color throughout, seams to be heat welded into unitized monolithic floor, Class 1 fire protection per ASTM E-648.

RESILIENT STAIR TREADS:
Single-piece units for width of stair or equal-length units if tread width exceeds available manufactured lengths. Provide rubber treads, FS RR-T-650, Type A, Class 2; size and style indicated. Basis of Specification is: Johnsonite Visually Impaired with Grit Color at Nosing of another color.

RESILIENT STAIR RISERS:
Single-piece risers for height and width of stair risers or equal-sized units if riser width exceeds available manufactured lengths. Provide rubber risers to match treads.

RESILIENT STRINGER SKIRT:
Cut to match riser and tread profile and to meet wall base height, of same material and color as base unless otherwise indicated.

RESILIENT EDGE STRIPS:
Not less than 1" width; 1/8" gage; tapered bullnose edge, color to match flooring or as selected by Architect.

RUBBER STAIR TREADS AND RISERS: Treads to be raised disc pattern of 3/4" diameter with a 2" wide continuous carborundum strip of contrasting color at the nosing for visually impaired. Nosing shall be adjustable to fit pan-filled steps. Treads shall be a tapered thickness of .210" to .113". Risers shall be coved with a 5/8" toe, approximately 1/8" thick, smooth, of same material as treads. Colors to be selected from manufacturer’s standard colors.

ADHESIVES (CEMENTS):
Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate.
conditions.

LEVELED COMPOUND:
Latex type as recommended by flooring manufacturer.

INSTALLATION:
Comply with flooring manufacturer's recommendations for type(s) of materials, project conditions, and intended use.

Room temperature shall be at least 70 degrees F. for 48 hours before, during, and 48 hours after installation.

Moisture Testing: For new concrete floors. Moisture readings shall be performed on concrete by the Calcium chloride test method. The calcium chloride test shall be done in every room vinyl composition tile is to be installed. The test kit must be in place sixty (60) hours minimum, seventy two (72) maximum and the temperature of the floor and surrounding area should be at least 65 degrees F. The slab must be brushed clean to remove any waxes, surface sealers, dust, dirt, oil or other surface contaminants. If test readings are below 3 lbs. per 1000 sq.ft. over 24 hours floor tile can be installed. If test results are above 3#/1000 S.F., the concrete subfloor must be allowed to dry until new tests provide results below 3#/1000 S.F., or written documentation provided by the vinyl composition tile manufacturer to allow a higher limit.

The General Contractor shall be responsible for providing a slab meeting the above requirements and pay for re-testing the floors. The test shall be performed by a qualified person with experience in doing the test. A copy of the test results location shall be marked on a floor plan and submitted to Owner and Architect prior to installation of flooring, with date of reading and name of person conducting test.

Clean floors and apply leveling compound and substrate primer if required, in accordance with flooring manufacturer's instructions.

Apply wall base in lengths as long as practicable to walls, columns, and all permanent fixtures where indicated. Mitered outside corners not acceptable.

At stairways, apply resilient accessories in strict compliance with manufacturer's installation instructions. Fill voids at nosing with epoxy caulk.

Install resilient edge strips at edges of resilient flooring which would otherwise be exposed.

On masonry or other irregular surfaces, fill voids behind base and along top edge with manufacturer's recommended adhesive filler.

Where sheet vinyl abuts hard tile, floor to belatexed a minimum 24" away and sloped up to hard tile
so sheet vinyl is flush with hard tile.

Clean floors and accessories after installation and apply protective polish in accordance with flooring manufacturer's instructions. Omit polish on "no-wax" flooring and tile indicated for "no-wax maintenance". Owner will apply protective polish.

Run sheet vinyl flooring up walls 4" or 6" as noted on room finish schedule and finish edge off with a metal runner. No wall base is required - up at cabinets toe spaces.

* * * * *
SECTION 09 65 66
RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

SUMMARY
The work of this section includes: Rubber flooring for first floor and walking track
Everlast Basic Rolls – as Specified as Basis of Design
Adhesives

Related Sections: Section(s) related to this section include:
Concrete Substrate: Division 3 Concrete Section(s).

REFERENCES
Standards listed by reference, including revisions by issuing authority, form a part of this
specification section to extent indicated. Standards listed are identified by issuing authority,
authority abbreviation, designation number, title, or other designation established by issuing
authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation
and standard designation.

American Society for Testing and Materials (ASTM):
ASTM C423 Test Method for Sound Absorption and Sound Absorption
Coefficients by the Reverberation Room Method.
ASTM C518 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by
ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and
Thermoplastic Elastomers – Tension.
ASTM D2047 Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as
measured by the James Machine.
ASTM E413 Classification for Rating Sound Insulation.
ASTM E492 Method for Laboratory Measurement of Impact Sound Transmission Through Floor-
Ceiling Assemblies Using the Tapping Machine.
ASTM F137 Test Method for Flexibility of Resilient Flooring Materials.
ASTM F710 Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient
Flooring.
ASTM F970 Test Method for Static Load Limit.
ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.


SYSTEM DESCRIPTION
Performance Requirements: Provide recycled rubber resilient flooring, which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

SUBMITTALS
General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

Product Data: Submit product data, including manufacturer’s guide specifications product sheet, for specified products.

Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors, patterns, and textures.

Samples: Submit selection and verification samples for finishes, colors, and textures.

Quality Assurance Submittals: Submit the following:

Certificates: If required, certification of performance characteristics specified in this document shall be provided by the manufacturer.

Manufacturer’s Instructions: Manufacturer’s installation instructions.

Closeout Submittals: Submit the following:

Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operational Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

Warranty: Warranty documents specified herein.

QUALITY ASSURANCE
Qualifications:

Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

Manufacturer’s Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.
Mock-Ups: Install at project site a job mock-up using acceptable products and manufacturer-approved installation methods. Obtain Owner and Architect’s acceptance of finish color, texture and pattern, and workmanship standard.

Incorporation: Mock-up may be incorporated into final construction upon Owner’s approval.

Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer’s instructions and manufacturer’s warranty requirements.

**DELIVERY, STORAGE & HANDLING**

General: Comply with Division 1 Product Requirements Sections.

Ordering: Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

Storage and Protection: Store materials at temperature and humidity conditions recommended by manufacturer and protect from exposure to harmful weather conditions.

**PROJECT CONDITIONS**

Temperature Requirements: Maintain air temperature in spaces where products will be installed for time period before, during, and after installation as recommended by manufacturer.

Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

**WARRANTY**

Manufacturer’s Warranty: Submit, for owner’s acceptance, manufacturer’s standard warranty document executed by authorized company official. Manufacturer’s warranty is in addition to, and not a limitation of, other rights owner may have under Contract Documents.

Warranty Period: 15 years commencing in Date of Substantial Completion in accordance with manufactures published warranty.

**MAINTENANCE**

Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.

Quantity: Furnish quantity of recycled rubber flooring units equal to 2% of amount installed.

Cleaning: Furnish manufactures neutral cleaner for initial cleaning and maintenance of finished floor surface.

Delivery, Storage and Protection: Comply with Owner’s requirements for delivery, storage, and protection of extra materials.
PART 2 PRODUCTS

Basis of Design: Everlast Basic Rolls – Recycled Rubber Flooring

Manufacturer: Ecore International

Contact: Garrett Melahn KRS Inc. garrett@krsinc.com; (414)-940-7150

Proprietary Product(s): Everlast Basic Rolls manufactured by Ecore, for fitness.

Everlast Basic Rolls, - recycled rubber resilient sheet flooring

E-Grip III™ one-component polyurethane adhesive

Everlast Fitness Flooring:

Roll Dimension 48” x 8 mm standard

Roll Weight [1.72 lb/ft² (8.39 kg/m²)]

Roll Length: 25 or 50 Lineal Feet

Standard Tolerances

Roll Width +3/4” -0”
Roll Length +1% -0”
Thickness +.3 mm -.3 mm

Colors: Everlast EL01 Buff Blue for the Field
Borderstrip: ECO Surfaces 905 – Granite Run

Product Testing:

Tensile Strength, lb/in² (ASTM D412): 200 min.
Flexibility, 1/4-inch mandrel (ASTM F137): pass.
Static Load, 1000 lb/in² (ASTM F970): less than 0.020 in.
Coefficient of Friction (ASTM 2047): greater than 0.9.
Chemical Resistance (ASTM F925):
5% Acetic Acid: No Change
70% Isopropyl Alcohol: No Change
5% Sodium Hydroxide: No Change
5% Hydrochloric Acid: No Change
5% Ammonia: No Change
Bleach: No Change
5% Phenol: No Change
Sulfuric Acid: No Change

Ambient Noise Reduction, Sabin/ft² (ASTM C423): 0.10.

Thermal Conductivity, BTU-in/hr-ft²-°F (ASTM C518): approximately 0.406.

Impact Insulation Class (ASTM E492): 45 minimum.

Sound Transmission Coefficient (ASTM 413): 45 minimum.

Force Reduction (ASTM F2569 / EN14808): Class 1
A. Product Name: One-part urethane adhesive under this specification shall be Ecore’s E-Grip III one-component urethane adhesive.

B. Material: E-Grip III is a one-component urethane moisture cured, non-sag permanently elastic adhesive that has excellent adhesion to elastomers, concrete, and wood and is engineered for indoor and outdoor applications.

C. Adhesive Type: One-component urethane

D. Adhesive Cure System: Moisture cured

E. Weight: 4 gallon pail-56 lbs, 2 gallon pail-28lbs, 10.1 oz cartridge

F. Color: Medium grey

G. VOC Content: 0 lb/gal calculated

H. Freeze/Thaw: Stable

I. Application Temperature: 40° F - 100° F

J. Calcium Chloride Test: (ASTM F1869) Maximum 5.5 lbs per 1,000 sq. ft. in 24 hrs.

K. Relative Humidity (RH) Test (ASTM) Maximum 85%

L. Flashpoint: > 500° F

M. Shelf Life: 12 months

N. Working Time: 30-40 minutes

O. Trowel: 1/16” x 1/16” x 1/16” square notch 1/8” x 1/8” x 1/8” square notch

P. Coverage Rate: 95 ft2 / gal. – 1/16” x 1/16” x 1/16” 60 ft2 / gal. – 1/8” x 1/8” x 1/8”

Q. SCAQMD Rule #1168 0 lb./gal. calculated
PRODUCT SUBSTITUTIONS
Substitutions: No substitutions permitted.

RELATED MATERIALS
Related Materials: Refer to other sections listed in Related Sections paragraph herein for related materials.

SOURCE QUALITY
Source Quality: Obtain recycled rubber resilient flooring materials from a single manufacturer.

PART 3– EXECUTION

MANUFACTURER’S INSTRUCTIONS
Compliance: Comply with manufacturer’s product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

EXAMINATION
Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer’s instructions.

PREPARATION
Surface Preparation: Per Manufacturer’s recommendations.

ERECTION / INSTALLATION / APPLICATION / CONSTRUCTION

FIELD QUALITY REQUIREMENTS
Manufacturer's Field Services: Upon owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

Site Visits: Attend Pre-construction meeting and provide Punch List at flooring completion.

CLEANING
Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

PROTECTION
Protection: Protect installed product and finished surfaces from damage during construction.

END OF SECTION
SECTION 09 65 67
RESILIENT ATHLETIC FLOORING – Room 402 ONLY

PART 1 - GENERAL

SUMMARY
Section Includes: Sheet vinyl resilient athletic flooring for Multi-purpose room 202

ACTION SUBMITTALS
Product Data: For each type of product indicated.
Manufacturer Certifications:
Provide certification that accurately identifies the Original Equipment Manufacturer (OEM) of
flooring furnished for this project including manufacturer’s name, address and factory location.

Suppliers of Private-Label flooring for this project must identify themselves as such and fully disclose
the OEM information listed above.

All “manufacturer” requirements in these specifications must be complied with by the OEM, including
warranties, certifications, qualifications, product data, test results, environmental requirements,
performance data, etc.

Provide ISO 9001 certification for the OEM of the specified products.

Provide ISO 14001 certification for the OEM of the specified products.

Laboratory Test Results:
Provide certification of testing per ASTM F2772-11 and the product being furnished complies with the
ASTM Indoor Sport Floor Classification specified for this project. Third-party certification required;
sales literature is not sufficient.

Shop Drawings: Showing installation details and locations of borders, patterns, game lines, locations
of floor inserts and seams.

Color samples:
Wood visual samples Minimum 6 inches by 8 inches to show that the appearance of wood plank pattern
complies with these specifications to be Oak color.

INFORMATIONAL SUBMITTALS
Qualification Data:
For a qualified resilient athletic flooring Manufacturer.
For a qualified resilient athletic flooring Installer.

CLOSEOUT SUBMITTALS
Submit three copies of the following:
Manufacturer maintenance instructions.
Manufacturer material warranty.
Installer installation warranty.

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QUALITY ASSURANCE
Manufacturer Qualifications:
ISO 9001 Certified.
ISO 14001 Certified.
At least ten years active experience in the manufacture and marketing of indoor resilient athletic flooring.
A provider of authorized installer training.

Installer Qualifications:
At least five years experience in the installation of resilient athletic flooring.
Experience on at least five projects of similar size, type and complexity as this project.
Employer of workers for this Project who are competent in techniques required by manufacturer for resilient athletic flooring installation indicated.

Fire Test Characteristics: As determined by testing identical products according to ASTM E 648, Class 1, by a qualified testing agency acceptable to authorities having jurisdiction.

Athletic Performance Properties: Comply with ASTM F 2772-11 Performance Level Class 2 for force reduction, ball bounce, vertical deformation and surface friction.

DELIVERY, STORAGE, AND HANDLING
Store flooring and installation materials in protected dry spaces, with ambient temperatures maintained within range recommended by manufacturer, but not less than 55 deg F (13 deg C) nor more than 85 deg F (29 deg C).

Store the indoor resilient athletic surfacing rolls in an upright position on a smooth flat surface immediately upon delivery to Project.

FIELD CONDITIONS
Product Installation:
Maintain temperatures during installation within range recommended by manufacturer, but not less than 65 deg F (18 deg C) in spaces to receive flooring for 48 hours prior, during and 48 hours after the installation.

After installation, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

Prohibit traffic during flooring installation and for at least 48 hours after flooring installation.

Install flooring only after other finishing work, including painting and overhead work, has been completed.

WARRANTY
Special Limited Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace sports flooring that fails within specified warranty period.

Material warranty must be direct from the product manufacturer.

- Material warranties from separate or third party insurance providers are not valid.
- Material warranties from private label distributors are not valid.
Failures include, but are not limited to, the following:

- Material manufacturing defects.
- Surface wear and deterioration to the point of wear-through.
- Failure due to substrate moisture exposure not exceeding 90 percent relative humidity when tested according to ASTM F2170 or 8 pounds moisture vapor emission rate when tested according to ASTM F1869.

Warranty Period:
For material defects and surface wear-through: 15 years from date of Substantial Completion.

For moisture vapor tolerance: 1 year from date of Substantial Completion.

Special Limited Warranty: Installer's standard form in which installer agrees to repair or replace sports flooring that fails due to poor workmanship or faulty installation within the specified warranty period.
- Warranty Period: 2 years from date of Substantial Completion.

ENVIRONMENT AND INDOOR AIR QUALITY
IEQ Credits: For adhesives and flooring, including a statement of VOC content.

Indoor Air Quality Certification:
Flooring products must be FloorScore® Certified.
- FloorScore® certification proves compliance with the volatile organic compound emissions criteria of the California Section 01350 standard.
- FloorScore® certification proves compliance with the testing and product requirements of the California Department of Health Services “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.”
- FloorScore® documentation must include certificate number for specified product.

Manufacturer’s certification of factory applied permanent Bacteriostatic and Fungicidal Treatment throughout the flooring material, not only on its surface, designed to improve indoor air quality and reduce asthma and allergy risks associated with bacterial and mold growth.

Manufacturer Certification of Environmental Procedures:
Original Equipment Manufacturer’s (OEM) ISO 14001 Certification
Coordinate layout and installation of flooring with other gymnasium equipment.

PART 2 - PRODUCTS

SHEET VINYL ATHLETIC FLOORING
Basis-of-Design Manufacture: Subject to compliance with requirements, provide Gerflor Taraflex Sport M Plus Sports Flooring installed with full-spread standard adhesive.

Substitution Limitations:
All other manufacturers: Submit formal substitution request prior to bid in accordance with Division 1 - Substitution Procedures
Approval by Architect of other manufacturers does not relieve Contractor of responsibility to provide products which comply with all requirements of this specification including full-spread adhesive coverage.
Product Description: Dual-durometer foam-backed sheet vinyl flooring designed for fully adhered athletic flooring applications.

- Overall Thickness: Not less than 0.28 inch (7 mm).
- Wear-Layer Thickness: Not less than 0.08 inch (2.1 mm)
- Backing: Very high density, two layer, dual-durometer, closed cell foam with reinforced fiberglass grid.
- Seaming Method: Heat welded.
- Adhesive Method:
  - Full-spread adhesive coverage to completely adhere flooring to substrate.
  - Complete adhesive coverage to eliminate the possibility of gaps or space between the slab and flooring material where moisture could accumulate and create an environment conducive to mold growth.
  - Flooring to be fully adhered to the concrete slab in all locations eliminating the possibility of waves or wrinkles forming caused by the floor shifting, moving or by rolling loads displacing it.

Traffic-Surface Texture: Wood visual shall have wood grain embossed texture for a genuine wood appearance and Solid colors to have “pebbled” embossed texture for an attractive appearance.

Bacteriostatic and Fungicidal Treatment: Manufacturer’s factory-applied permanent treatment throughout the flooring material which can improve indoor air quality and reduce asthma and allergy risks associated with bacterial and mold growth.

- Basis-of-Design Product: Gerflor Sanosol
- Applied Finish: Manufacturer's, factory-applied, permanent and UV-cured.
  - No-Wax finish: Published product literature identifying factory applied finish as, “No-Wax-Just clean and rinse”
- Basis-of-Design Product: Gerflor Protecsol.

Field-Applied Finishes: None required and not allowed.

Roll Size:
- Roll Width: Rolls to be a minimum width of 59 inches (1.5 m) wide.
- Roll Length:
  - Wood visual rolls to be a minimum length of 86 feet, 6 inches (26.4 m) to minimize the number of end-seams.
  - Solid color rolls to be a minimum length of 67 feet, 3 inches (20.5 m) to minimize the amount of waste if accent colors are selected for boarders, keys or center circle.
  - Roll length of wood visual flooring shall be sufficient to cover the full length of a high school main basketball court (84’-0”) without splicing or end-of-roll (butt) seams within main court boundary.

Color and Pattern:
- As selected by Owner from manufacturer's standard colors and patterns – Oak Color.
- Wood pattern shall accurately simulate the true visual appearance of natural athletic wood strip flooring.
  - Pattern shall replicate random-length stock by simulating non-uniform board lengths ranging from 18 inches to 48 inches with a maximum board width of 2-1/2 inches.
Wood pattern shall not include a dark line simulating edges or ends of individual boards.

Surface texture shall simulate realistic wood grain and not be raised or "pebbled" embossing.

Performance Criteria:
ASTM F 2772-11 Indoor Sport Floor Standard:
- Provide certification of compliance for the four ASTM F2772 Indoor Sport Floor Standard performance categories:
  - Shock Absorption/Force Reduction:
    - Class C2 (22% to 33%). Pass
  - Ball Bounce:
    - Minimum 90%: Pass
  - Surface effect/Coefficient of Friction:
    - Between 80-110: Pass
  - Vertical deformation:
    - Maximum 3.5mm: Pass

Static Load Limit/Residual Indentation:
ASTM F1303; Pass Static Load Resistance requirement of less than 0.005 inch of residual indentation as tested per ASTM F 970 at prescribed test load of 175 p.s.i.
EN 1516; Pass, Less than or equal to 0.5 mm.

1. Resistance to Rolling Load: EN 1569; Pass.
2. Chemical Resistance: ASTM D 543; OK.
5. Sound Insulation: EN ISO 717; 18 dB.
7. Organic Emission: ASTM D 5116; Pass
8. Fire Performance: ASTM E 648; Greater than 0.45 W/cm2, Class 1.
9. Surface Maintenance Requirements: No-wax surface requiring only cleaning and rinsing.
10. Slab Moisture Design Tolerance:
    - Maximum relative humidity of 90 percent when tested according to ASTM F 2170.
    - Maximum moisture vapor emission rate of 8 pounds of water per 1000 sq. ft. in 24 hours when tested according to ASTM F1869.

ACCESSORIES

Adhesives: Water-resistant type recommended by athletic flooring manufacturer for substrate and conditions indicated.
- Coverage Type: Full-spread application for 100% coverage.

Heat Welding Rod: As supplied by indoor resilient athletic flooring manufacturer. Color shall blend with resilient athletic flooring color.

Marker Paint: Complete system including primer, compatible with flooring and

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recommended by flooring and paint manufacturers.

PART 3 - EXECUTION

EXAMINATION
Verify the Following:

1. The area in which the indoor resilient athletic flooring will be installed is dry, weather-tight and in compliance with specified requirements.
2. Permanent heat, lighting and ventilation systems are installed and operable.
3. Other work, including overhead work, that could cause damage, dirt, dust or otherwise interrupt installation has been completed or suspended.
4. No foreign materials or objects are present on the substrate and that it is clean and ready for preparation and installation.
5. Tests to verify that the moisture evaporative rate or substrate relative humidity is within the specified ranges.
6. The concrete slab surface pH level is within the specified range.
7. The concrete slab surface deviation is no greater than 3/16 inch within 10 feet (3.2 mm within 3 m) when measured according to ASTM E 1155.
8. The concrete slab complies with ACI 302.2R for concrete design including use of a low-permeance vapor barrier directly beneath the concrete subfloor with sealed penetrations.

PREPARATION
Prepare substrates according to manufacturer’s written recommendations to ensure proper adhesion of resilient athletic flooring system.

Concrete Substrates: Prepare according to ASTM F 710.
Verify that substrates are dry and free of sealers, curing compounds and other additives.
Remove coatings and other substances that are incompatible with adhesives using mechanical methods recommended by manufacturer.

Alkalinity Testing: Perform pH testing according to ASTM F 710. Proceed with installation only if pH readings are between 7.0 and 8.5.

Moisture Testing: Perform ASTM F 2170 relative humidity test and proceed with installation only after substrates have maximum relative humidity of 90 percent. Or perform ASTM F 1869 calcium chloride test and proceed with installation only after substrates have maximum moisture-vapor-emission rate of 8 lb of water/1000 sq. ft. in 24 hours.

Use trowelable concrete based leveling and patching compound with the same moisture vapor tolerance as the adhesive to fill depressions, holes, cracks, grooves or other irregularities in substrate.

Place flooring and installation materials into spaces where they will be installed at least 48 hours before installation. Install flooring materials only after they have reached the same temperature as space where they are to be installed.

Sand the surface of the concrete slab.
Sweep and then vacuum substrates immediately before installation. After cleaning, examine substrate for moisture, alkaline salts, grit, dust or other contamination. Proceed with installation only after unsatisfactory conditions have been corrected.
SHEET ATHLETIC FLOORING INSTALLATION

General:

Comply with resilient athletic flooring manufacturer's installation instructions.

Take necessary precautions to minimize noise, odors, dust and inconvenience during installation.

Fit flooring neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.

Lay out flooring as follows:

Minimize number of seams and place them inconspicuous areas.

Locate seams as shown on approved Shop Drawings.

Adhered Flooring: Attach products to substrates using a full-spread of adhesive applied to substrate to comply with adhesive and flooring manufacturer instructions.

Vinyl Sheet Flooring Seams: Finish seams to produce surfaces flush with adjoining flooring surfaces. Comply with ASTM F 1516. Rout joints and use heat welding rod to permanently and seamlessly fuse sections together.

LOGOS

Lay out logos to comply Wrightstown High School logo in center of floor area of Multi-purpose room 202.

Mask flooring at game lines and logos, and apply paint of color indicated to produce clean, sharp and distinct edges.

CLEANING AND PROTECTION

Perform the following operations after completing resilient athletic flooring installation:

- Remove marks and blemishes from flooring surfaces.
- Sweep and then vacuum flooring.
- Damp-mop flooring to remove soiling.

Protect flooring from abrasions, indentations, and other damage from subsequent operations and placement of equipment, during remainder of construction period.

END OF SECTION
SECTION 09 80 00
SOLID SURFACE WINDOW STOOLS & COUNTERTOPS

PART 1 - GENERAL

Applicable provisions of Division 1 shall govern all work under this section.

SECTION INCLUDES
Solid surface window stools and reception desk countertops.

REFERENCES

SUBMITTALS
Product Data: Manufacturer's data sheets on each product to be used, including:
- Preparation instructions and recommendations.
- Storage and handling requirements and recommendations.
- Specimen warranty.
Shop Drawings: Complete details of materials and installation.
Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
Installation Instructions: Manufacturer's installation instructions and recommendations.
Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of surfaces.

DELIVERY, STORAGE, AND HANDLING
Store products in manufacturer's unopened packaging until ready for installation.
Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

PROJECT CONDITIONS
Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS
COUNTERTOP ASSEMBLIES
Solid Surfacing: Solid surfacing sheet over continuous substrate.
- Flat Sheet Thickness: 1/2 inch, minimum.
- Solid Surfacing Sheet: Complying with ISSFA-2 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E 84.

NSF approved for food contact.

Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.

Color and Pattern: See Section 09 00 00 Color Selection for Basis of Design.

Manufacturers:
- Dupont
- Formica Corporation
- Meganite
- Aristech Acrylics
- Wilsonart International, Inc.
- Hi-Macs
- Romanite
- Or approved equal.

ACCESSORY MATERIALS
Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

FABRICATION
Solid Surfacing: Fabricate up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 - EXECUTION

EXAMINATION
Do not begin installation until substrates have been properly prepared.

If substrate preparation is the responsibility of another installer, notify General of unsatisfactory preparation before proceeding.

PREPARATION
Clean surfaces thoroughly prior to installation.

Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

INSTALLATION
Attach solid surfacing to window stools and countertops using compatible adhesive.
Seal joint between window stool and window/wall with compatible sealant.

CLEANING AND PROTECTION
Clean surfaces thoroughly.
Protect installed products until completion of project.
Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 09 90 00
PAINTING

GENERAL
Applicable provisions of Division 1 shall govern work under this Section.

WORK INCLUDED:
Furnish and apply all field applied paint finishes.
Furnish and apply all field applied transparent finishes.

SUBMITTALS
Prior to beginning work, Architect will furnish color chips for surfaces to be painted. In addition to manufacturer's data, application instructions, and label analysis for each coating material, submit samples for Architect's review of color and texture only. Resubmit samples if requested until required sheen, color and texture is achieved.

On actual wall surfaces and other building components, duplicate painted finishes of acceptable samples, as directed by Architect.

DESCRIPTION OF WORK
Painting and finishing of interior and exterior items and surfaces, unless otherwise indicated.

Paint exposed surfaces, except as otherwise indicated, whether or not colors are designated. If not designated, colors will be selected by Architect from standard colors available for the coatings required.

Compatibility with sealants applied before painting: See Section 07900 -Joint Sealants and Installer of Sealants to ensure compatibility between caulking used and paint products to be used to paint over sealants.

Primer coat will be one color, preferably white, first finish coat will be tinted a different color which will also be different than the second final coat color selected. Before proceeding with each coat notify Owner/Architect for review.

WORK NOT INCLUDED
Unless otherwise indicated, shop priming of ferrous metal items and fabricated components are included under their respective trades. Pre-finished items, such as metal toilet partitions, acoustic material and the like, are not included. Unless otherwise indicated, painting not required on surfaces of concealed areas. Finished metals such as anodized aluminum, stainless steel, bronze, and similar metals will not be painted unless called for on drawings, to be field painted. Note that all exposed flashing and aluminum metals to be field painted. Do not paint any moving parts of operating units, or over any equipment identification, performance rating, name or nomenclature plates or
code-required labels.

ROOF TOP ITEMS
Will be required to be painted if exposed to view from the ground as determined by the Architect.

DELIVERY AND STORAGE
Deliver materials to job site in new, original, and unopened containers bearing manufacturer's name, trade name, and label analysis. Store where indicated in accordance with manufacturer's instructions.

JOB CONDITIONS
Do not apply paint in snow, rain, fog or mist or when relative humidity exceeds 85%. Do not apply paint to damp or wet surfaces. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F. (10 degrees C) and 90 degrees F. (32 degrees C); for solvent-thinned paints: between 45 and 95 degrees F., unless otherwise permitted by paint manufacturer's printed instructions.

Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

PROTECTION
Protect work of other trades. Correct any painting related damages by cleaning, repairing or replacing, and refinishing, as directed by Architect.

COORDINATION
Provide finish coats which are compatible with prime paints used. Provide barrier coats over incompatible primers where required. Notify Architect in writing of anticipated problems using specified coatings with substrates primed by others.

SURFACE PREPARATION
Perform preparation and cleaning procedures in strict accordance with coating manufacturer's instructions for each substrate condition.

Remove hardware and accessories, machined surfaces, plates, lighting fixtures and similar items in place and not to be finish-painted or provide surface-applied protection. Reinstall removed items and remove protective coverings at completion of work.

Prepare cementitious surfaces of concrete, concrete block and similar materials to be painted by removing efflorescence, chalk, dust, dirt, grease and oils, and by roughing to remove glaze. Determine alkalinity and moisture content of surfaces to be painted before beginning painting. Do not paint over surfaces where alkalinity or moisture content exceeds manufacturer's recommendations.
Seal wood required to be job-painted or stained. Prime edges, ends, face, undersides and backsides of counters, cases, cabinets, counters, etc. Use spar varnish for backpriming where transparent finish is required.

Clean ferrous surfaces which are not galvanized or shop coated. Remove oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning. Touch-up shop-applied prime coats wherever damaged.

Clean galvanized surfaces free of oil and surface contaminants with non-petroleum based solvent.

MATERIAL PREPARATION
Mix, prepare, and store painting and finishing materials in accordance with manufacturer's directions.

APPLICATION
Apply painting and finishing materials in accordance with manufacturer's directions. Use applicators, and techniques best suited for materials and surfaces to which applied.

Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.

Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before equipment is installed.

Paint interior surfaces of ducts, where visible through registers or grilles, flat, non-specular black.

Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

Finish exterior doors on tops, bottoms and edges same as exterior faces, unless otherwise indicated.

Sand lightly between succeeding enamel or varnish coats.

Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise specified.

Apply prime coat to material which is required to be painted or finished, and which has not been prime coated by others.

Apply each material at not less than the manufacturer's recommended spreading rate, to provide a total dry film to thickness of not less than 4.0 mils for entire coating system of prime and finish coats for 3-coat work.

Provide a total dry film thickness of not less than 2.5 mils for entire coating system of prime and
finish coat for 2-coat work.

If wood doors are factory prefinished wood doors are undercut at job site, cuts shall be sealed by painter.

At finished wood trim, fill all nail holes after sealer coat and varnish over.

COMPLETED WORK
Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

MATERIALS
Only top-o-line professional product line paint shall be used of an approved manufacturer. Paint shall be ready-mixed except that tinting and thinning may be done at the job. All paint materials shall be delivered in original unopened containers with labels and tags intact. Use best grade products of the retail line. Lead base paint is prohibited. Product used shall result in a hard, durable, non-chalking surface that is scrubbable without causing the paint to soften. The following specification is based on Sherwin-Williams paint, other manufacturers approved as approved by the architect such as PPG is Pre-approved. SPECIAL NOTE: The majority of wall and ceiling paint shall be only PPG Paint-color: “SNOW MIST”.

CLEAN UP
At the completion of painting work, all scaffolding, containers and debris shall be removed from the area. Paint spots, oil or stains upon adjacent surfaces and fixtures shall be removed and the job left clean and acceptable to the satisfaction of the Architect and the Owner.

All prefinished surfaces shall be touched-up with material as recommended by the manufacturer.

Leave with Owner one unopened quart container of each color of paint, stain and varnish.

FINISH NOTES
Painter shall provide painted finish on all exterior HVAC grilles, vents, louvers and gas lines that are not factory prefinished. Paint to match wall color in which items occurs.

Access doors and panels, exposed pipes, exposed ducts and radiation shall be painted the same color as adjacent wall or ceilings.

Miscellaneous Metal: Miscellaneous or ornamental exposed to view (from floor or ground level) including flashing, steel angles, roof ventilators and vents, and flues, shall be painted as specified herein for interior or exterior metal surfaces.

Painter shall review all masonry surfaces prior to painting. Surfaces shall be filled of all voids by the mason contractor. When surface is acceptable, painter may begin painting work. If surface is unacceptable, contact the General Contractor for correction.
PAINTING SCHEDULE

Refer to Room Finish Schedule on the drawings for co-ordination of painted finishes specified herein.

Partial List of Paint or Stain Work Required is as Follows:

- Interior Concrete Block Walls
- Interior Gypsum Board with Texture Finish
- Interior Metal Exposed to View
- Interior Wood Called to be Painted or Stained
- Interior Hollow Metal Doors and Frames
- Interior wood doors to be stained and sealed.
- Interior exposed structure and all exposed HVAC, electrical, equipment that does not have a factory prefinish.
- Exterior Hollow Metal Doors and Frames
- Exterior metal louvers.
  - Exterior and interior structural steel exposed to view.
- Mechanical and Electrical Equipment exposed to view and not located within Mechanical Equipment Room shall be painted.
- Surfaces called out in schedule on drawings to be "Painted" unless otherwise noted shall be:
  - Interior Gypsum Board Over Spary on Texture
    1st Coat: Sherwin Williams Latex Wall Primer B28W200
  - Interior-Concrete Block - Latex Enamel
    1st Coat: Sherwin Williams Promar Interior/Exterior Block Filler B25W25
  - Interior and Exterior Metal - Bare (Not Primed)
    1st Coat: Sherwin Williams - DTM Acrylic
    2nd & 3rd Coat: Sherwin Williams - DTM Acrylic Semi-Gloss
  - Previously Painted - Interior Metals
    Called to be painted - REMOVE RUST
    One Coat: Sherwin Williams Promar 200 Latex Semi-Gloss Enamel
  - Exterior Metal - Bare - Galvanized Surface
  - Exterior Metal - Bare - Steel
    1st Coat: Sherwin Williams DTM Acrylic
2nd & 3rd Coat: Sherwin Williams DTM Acrylic Semi-Gloss

Primed Interior Metal such as Hollow Metal Doors, Frames, Convector Cabinets:
1st and 2nd coat: Sherwin Williams Promar 200 Latex Semi-Gloss Enamel

Exterior Metal - Primed
1st & 2nd coat: Sherwin Williams DTM Acrylic Semi-Gloss Enamel

Interior Wood - Painted
1st coat: Sherwin Williams Promar 200 Alkyd Enamel Undercoat B49 Series
2nd & 3rd coat: Sherwin Williams Promar Latex Semi-Gloss Enamel

Interior Wood - Stained
Sand with fine sandpaper and dust clean.
1st coat: Sherwin Williams Promar 200 Alkyd Enamel Undercoat B49 Series
2nd coat: Sherwin Williams Promar Varnish Sanding Sealer B26V3.
Varnish Coat: Sherwin Williams Oil Base Varnish A66F90.

Concrete Ceilings
Touch Up: Sherwin-Williams DTM Acrylic Primer B66W1
1st and 2nd Coat: Sherwin Williams Waterborne Acrylic Dryfall Semi-Gloss B42WW2

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SECTION 10 16 00
TOILET PARTITIONS

GENERAL
Applicable provisions of Division 1 shall govern work under this Section.

WORK INCLUDED
Furnish and install new toilet partitions.

RELATED WORK
Section 10 80 00 - Toilet and Miscellaneous Accessories
Division 15 - Plumbing

SUBMITTALS
Manufacturer's data and installation instructions.

ACCEPTABLE MANUFACTURERS
Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are limited to, the following:

- Comtec Industries - Floor Mounted Overhead Braced

MATERIALS
Doors, panels and pilasters are constructed of 1" thick solid HDPE resin which is water resistant, non-absorbent and has a self-lubricating surface that resist markings from pens, pencils and other writing instruments. Color and material is homogeneous throughout and is selected from comtec's standard Series S200. All doors, panels and pilasters are covered with protective masking.

Panels are 1" thick HDPE with edges uniformly machined to a 1/4" radius. Panels are 55" high and anchored to walls and pilasters with 54" continuous plastic wall brackets.

Doors are 1" thick HDPE with all edges uniformly machined to a 1/4" radius. Doors are 55" high and anchored to walls and pilasters with 54" continuous plastic wall brackets. Furnish 24" wide in swinging doors for ordinary stalls and 36" wide outswing doors at stalls for use by handicapped.

Pilasters are 1" thick HDPE with all edges uniformly machined to a 1/4" radius. Pilasters are 82" high and anchored to panels and walls with 54" continuous plastic wall brackets. The pilasters contain no less than one level adjusting bolt on the bottom and attach to the floor in a stainless steel pilaster shoe. Pilasters are overhead braced with an aluminum headrail.

Aluminum Hinges are 8" gravity/cam acting made of heavy-duty extruded aluminum (6463-T5...
alloy) with bright dip anodized finish and wrap-around flanges. Hinges are pre-drilled and weight no less than 1.5 pounds per linear foot. Hinge wall thickness is .175”. The cam is constructed from a 3/4" diameter nylon rod and a 5/14" stainless steel pin. Hinges are through-bolted onto doors and pilasters using stainless steel, tamper resistant sex bolts. Hinges are factory set to a full close position unless otherwise specified.

Plastic wall brackets are 54” long and made of heavy-duty extruded PVC resin available in blue, brown, white, black, grey and beige. Plastic wall brackets are pre-drilled with holes, spaced every 10’ along the full length of the bracket and they weigh no less than .95 pounds per linear foot (double ear). The bracket wall thickness is .188”. Wall brackets are mounted to pilasters with stainless steel, tamper resistant torx screws. Panels are through-bolted into brackets with stainless steel, tamper resistant sex bolts. The attachment of brackets to the adjacent wall construction is accomplished with #14 x 1-1/2” stainless steel phillips-head screws and plastic anchors.

Stainless steel pilaster shoes are 3” high, and constructed from 20-gauge stainless steel. Pilaster shoes are anchored to the finished floor with #14 x 1-1/2” stainless steel phillips-head screws and plastic anchors. Pilaster shoes are through-bolted onto pilaster with stainless steel, tamper resistant sex bolts.

Latches are fabricated from heavy-duty extruded aluminum (6463-T5 alloy). Latch housing has a bright-dip anodized finish. Slide and button have a black anodized finish. Latch is mounted to the door with stainless steel, tamper resistant sex bolts.

Strike and keeper is 6” long and fabricated from heavy-duty extruded aluminum (6463-T5 alloy) with bright-dip anodized finish wrap-around flanges. Strike and keeper is mounted to the pilaster with stainless steel, tamper resistant sex bolts. The bumper is made of flexible vinyl.

Headrail is made of heavy-duty extruded aluminum (6463-T5 alloy) with bright-dip anodized finish. Headrail is anti-grip and attaches to the top of the pilasters with stainless steel, tamper resistant torx screws. Headrail is attached to the adjacent wall construction with a stainless steel headrail bracket.

Headrail bracket is made of 16 gauge stainless steel and is attached to the adjacent wall construction with #14 x 1-1/2” stainless steel phillips-head screws and plastic anchors.

INSTALLATION
Shall be by supplier experienced with installation of manufacturers product. Install partitions rigid, straight, plumb and level in accordance with manufacturer's printed instructions. See units with not more than 1/2” between pilasters and panels, and not more than 1” clearances between panels and walls.

HARDWARE ADJUSTMENTS
Adjust and lubricate hardware for proper operation after installation.

Set hinges on in-swing doors to hold doors open approximately 30 degrees from the closed position when unlatched.

Set hinges on out-swing doors to return to fully closed position.

CLEANING AND FINAL ADJUSTMENTS

Perform final adjustments to leveling devices, door hardware, and other operating parts. Clean exposed surfaces and touch up minor finish imperfections using materials and methods recommended by partition manufacturer.

Replace damaged units which cannot be satisfactorily field repaired, as directed by Architect.

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SECTION 10 44 00
SPECIALTY SIGNS

GENERAL
Applicable provisions of Division 1 shall govern work of this Section.

WORK INCLUDED
Signages - interior and exterior.

DESCRIPTION OF WORK
Owner will provide and install room signage.
SECTION 10 52 20
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

Applicable provisions of Division 1 shall govern work under this section.

SECTION INCLUDES
Fire extinguisher cabinets.

RELATED SECTIONS
Section 04 20 00 - Unit Masonry.
Section 09 21 16 - Gypsum Board Assemblies.

REFERENCES

PERFORMANCE REQUIREMENTS
Conform to NFPA 10.
Fire extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated will be provided by Owner.

SUBMITTALS
Shop Drawings: Indicate cabinet physical dimensions.
Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

PART 2 - PRODUCTS

MANUFACTURERS
Fire Extinguishers, Cabinets and Accessories:
JL Industries, Inc.
Larsen's Manufacturing Co.
Potter-Roemer
Or approved equal.

FIRE EXTINGUISHERS
To be supplied by Owner – Equal to JL Industries Model COS-MIC 5E-5lb capacity U/L Rating 3A-40BC.

FIRE EXTINGUISHER CABINETS – Basis of Design is JL Industries Model 1816
Metal: Formed primed steel sheet; 0.036 inch thick base metal.

Cabinet Configuration: Semi-Recessed type.
Exterior nominal dimensions of 13-7/8 inch wide x 27-3/8 inch high x 4 inch deep.

Trim: Returned to wall surface, 1 ½” square trim.
Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and
Door stiles.

Door: Frameless acrylic, clear, 1/8 inch thick. Set in resilient channel gasket glazing. Provide nylon catch. Hinge doors for 180 degree opening.

Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

Weld, fill, and grind components smooth.

Finish of Cabinet Exterior Trim and Door: Baked enamel, color selected by Owner

Finish of Cabinet Interior: White enamel.

PART 3 - EXECUTION

EXAMINATION
Verify existing conditions before starting work.
Verify rough openings for cabinet are correctly sized and located.

INSTALLATION
Install in accordance with manufacturer's instructions.
Install cabinets plumb and level in wall openings, 64 inches from finished floor to top of cabinet.
Secure rigidly in place.

END OF SECTION
SECTION 10 55 00
METAL LOCKERS

GENERAL: Applicable provisions of Division 1 shall govern work of this Section.

WORK INCLUDED:
New lockers located in Vestibule 101 as noted on the floor plans.

SUBMITTALS:
In addition to product data and installation instructions, provide samples of each color and finish required.
Submit shop drawings for metal lockers, verifying dimensions affecting locker installation; include installation details, bases, trim, accessories, and numbering sequence information.

MANUFACTURER:
Subject to compliance with requirements, provide products by one of the following:
De Bourgh Manufacturing Co.
List Industries Inc.
Lyon Metal Products
Penco Products Inc.
Olympus

COLORS AND PATTERNS:
As selected by Architect from manufacturer’s standard colors and patterns.

FABRICATION, GENERAL:
Construction: Square, rigid, without warp, exposed edges safe to touch. Frames welded together; other joints welded, riveted, or bolted as standard with manufacturer with no bolts or rivets exposed on front of doors and frames. Welds ground flush. Provide extra bracing or reinforcing for doors over 15 inches wide.
Frames: Steel 16-gage channels or 12-gage angles, with continuous stops/strike formed on vertical members.
Hinges: Steel, full loop, 5 knuckle, tight pin, welded to frame, screwed or riveted to door. Provide 2 hinges per door 42 inches and under and 3 hinges for doors over 42 inches high.
Finish: Manufacturer’s standard baked enamel in colors indicated, or as selected from manufacturer’s standard colors.

WARDROBE LOCKERS:
Double tier and triple tier lockers - and Single tier lockers 12” WIDE X 12” DEEP X 12” HIGH –
and 12" WIDE X 12" DEEP X 24" HIGH –and 12" WIDE X 12" DEEP X 48" HIGH –BODY.

Body: Fabricate back, sides, top, and bottom of 20-gage sheet steel, with double-flanged connections extending full height at back and sides, flanged edges at top and bottom.

Form exposed ends of non-recessed lockers of 16-gage steel.

Doors: Provide 180 degree opening, one-piece doors formed of 14-gage sheet steel, flanged at all edges, constructed to prevent springing when opening or closing.

Ventilation: Provide stamped, louvered vents in door face, as follows:

Double-tier Lockers: Minimum three louver openings, top and bottom.

Projecting Handle and Latch: Pry-resistant latch and pull with rubber silencers, chromium plated, vandalproof, lift-up handle, with strike and eye for padlock.

Double-tier Lockers: Minimum two-point latching.

**LOCKER ACCESSORIES:**

Equipment: One double-prong ceiling hook and not fewer than 2 single prong wall hooks per locker except on the 12” x 12” size.

Number Plates: Manufacturer's standard, nonferrous metal, attached to door with matching fasteners; number sequence as directed by the Owner.

Provide trim at jamb and head of recessed lockers, consisting of not less than 18 GA - cold rolled steel, factory finish to match lockers. Secure trim to lockers with concealed fastening clips.

Filler Panels: 16-gage steel sheet, factory fabricated and finished to match locker units if required.

Padlock: Furnished by Owner.

Sloping Tops: 20-gage steel, approximately 25 degrees pitch, continuous with closures at exposed ends, finished to match lockers.

Lockers to sit on a base as detailed on the drawings.

**INSTALLATION:**

Plumb, level, rigid in compliance with manufacturer's instructions. Provide trim and filler panels as required using concealed fasteners. Fasten lockers to floor unless otherwise indicated.

Adjust doors and latches to operate easily without binding. Verify that integral locking devices are operating properly.
1 Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance.
2 Use only materials and procedures recommended or furnished by locker manufacturer.

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SECTION 10 80 00
TOILET AND MISCELLANEOUS ACCESSORIES

GENERAL
Applicable provisions of Division 1 shall govern work of this Section.

RELATED WORK
Section 04 20 00 - Masonry Walls
Section 09 25 00 - Gypsum Board Partitions
Section 10 16 00 - Toilet Partitions

DESCRIPTION OF WORK
Contractor shall provide and install the following toilet and miscellaneous accessories as shown on plans and interior elevations. Verify quantity required as shown on Drawings.

- Grab Bars
- Mop Holder Strip
- Robe Hooks

Materials supplied and installed by Owner to include toilet paper holders, towel dispensers, soap dispensers, waste receptacles.

Mirrors are specified in Section 10830.

Some types of toilet accessories are included as part of Section 10160 - Toilet Partitions.

QUALITY ASSURANCE
Accessory locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.

SUBMITTALS
Product data: Submit manufacturer's technical data and installation instructions for each toilet accessory.

ACCEPTABLE MANUFACTURERS
Available Manufacturers: Subject to compliance with requirements, manufacturers offering toilet accessories which may be incorporated in the work include, but are not limited to, the following:

- A&J United Machine & Metal Products Corp.
- Accessory Specialties, Inc.
- American Dispenser Co., Inc.
- Bobrick Washroom Equip., Inc.
- Bradley Corp.
McKinney/Kidde, Inc.
The Charles Parker Co.
Watrous, Inc.
Franklin Brass Manufacturing Co.
F.H. Lawson Co.
G.M. Ketcham Co., Inc.
Moore Dispensers, Inc.
Saferail, Inc. - Manufacturer of Grab Bars

MATERIALS, GENERAL

Fasteners: Screws, bolts and other devices of same material as accessory unit or of galvanized steel
where concealed.

Grab Bars:

1) Stainless steel type: Provide grab bars with wall thickness not less than 18 gage and as
   follows:
2) Mounting: Concealed, manufacturer's standard flanges and anchorages. Mount 33" to 36"
   above finish floor.
3) Clearance: 1-1/2" clearance between wall surface and inside face of bar.
4) Gripping surfaces: Manufacturer's standard safety grip texture as approved by Wisconsin
   Administrative Code.
5) Heavy-duty size: Outside diameter of 1-1/2". Must sustain 250 lb. load.
6) Provide grab bars in sizes indicated on the drawings.

Mop Holder: Surface mount, heavy gage 304 stainless steel. Three spring activated rubber cam
   holders on steel retainers. Equal to bradley Model 9953. Install by mop sinks.

INSTALLATION

Install toilet accessory units in accordance with manufacturer's instructions, using fasteners which
are appropriate to substrate and recommended by manufacturer of unit. Install units plumb
and level, firmly anchored in locations indicated.

Adjusting and Cleaning: Adjust accessories for proper operation and verify that mechanisms
function smoothly. Replace damaged or defective items.

Clean and polish all exposed surfaces after removing protective coatings.

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SECTION 10 83 00
MIRROR UNITS

GENERAL
Applicable provisions of Division 1 shall govern work under this Section.

WORK INCLUDED
Furnish and install theft-resistant mirrors in restrooms as shown on interior elevations.
Furnish and install continuous frameless mirrors on the East and West walls of the Multi-purpose
room 202. Mirrors to start above 4 inch high vinyl base and be 7’-0” tall.

RELATED WORK:
Section 10 80 00 - Toilet Accessories

SUBMITTALS
Manufacturer's product data and installation instructions. Warranty: Provide manufacturer's written
15-year warranty against silver spoilage of mirrors.

MANUFACTURERS
Subject to compliance with requirements, provide mirror units as manufactured by one of the
following:
Bobrick Washroom Equipment, Inc.
Bradley Corporation
McKinney/Kidde, Inc.

MATERIALS
Mirror glass: 1/4" thick, Type I, Class 1, Quality q2, conforming to FS DD-G-451, with silvering,
copper coating, and protective organic coating complying with FS DD-M-411.
Stainless Steel Framing: AISI Type 302/304, with polished No. 4 finish. For mirrors in toilet rooms
frame to be 18 GA. All corners welded and smooth.

Hangers: Provide system of mounting mirror units which will permit rigid, tamperproof and
theftproof installation.

STAINLESS STEEL CHANNEL FRAMED MIRRORS
Mirror without shelf: Equal to Bradley Model 781. Mirror shall be framed with one-piece roll
formed stainless steel with 3/4" face and neatly mitered corners. Mirror shall be of first
quality 1/4" polished plate glass, guaranteed for 15 years against silver spoilage and
protected by shock absorbing waterproof filler. See drawings for size.
Installation: Secure mirrors to walls in concealed tamperproof manner with special hangers, toggle
bolts, or screws. Set units plumb, level, and square at locations indicated, in accordance with
manufacturer's instructions for type of substrate involved.

Clean exposed surfaces of mirror units in compliance with manufacturer's recommendations.

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SECTION 22 01 00
BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1
specification sections, apply to work under this Section.

DESCRIPTION OF WORK
Requirements of Instructions to Bidders, General and Project Requirements apply to work under this Division,
which shall include:

- Section 22 01 00 – Basic Plumbing Requirements
- Section 22 05 00 – Basic Plumbing Materials & Methods
- Section 22 05 05 – Firestopping
- Section 22 07 00 – Plumbing Insulation
- Section 22 14 23 – Drain Tile
- Section 22 42 00 – Commercial Plumbing Fixtures

Furnish and install all items of work shown on the drawings, within the specifications, and in compliance with the
Wisconsin Uniform Plumbing Code and local authorities.

Provide everything essential for the completion of work to make the system ready for normal and proper operation,
including all work or materials not directly shown on the drawings or in the specifications, but necessary for the
proper operation of the system.

All work shall be performed to the satisfaction of the Architect, Engineer, and Owner.

Secure all permits and licenses applicable to this Division and pay all fees, including posting all bonds incidental
thereto. Plan review submittal to the Wisconsin Department of Safety and Professional Services, Technical Services
Division, shall be by the Architect.

RELATED WORK ELSEWHERE
Thoroughly inspect entire set of plans and specifications as to the class of building construction in general and
specifically to the items of other divisions that affect the work of this Division.

Work of this Division also includes any plumbing work shown on the plans and included in the specifications of
other Divisions.

Plans and specifications of this Division are intended for a complete project. If trade jurisdiction requires portions
of the work be done by other tradesmen, this Contractor shall sublet those portions of the work to qualified
Contractors, however this Contractor shall be held fully responsible for all such installations.

SHOP DRAWINGS
Submit electronic files with dimensions, capacities, and information as soon as available from manufacturers.

Shop drawings shall include, but are not limited to, the following items and equipment:
- Plumbing Fixtures and Trim.
- Drains and Cleanouts.
- Pipe Insulation.
All shop drawings, product data, and samples submitted shall illustrate details of work, equipment, materials, products, systems, designs or workmanship that the Contractor intends to use in order to comply with the design concept established in the Contract Documents. Review of these submittals by the Architect or its representative is only for the limited purpose of checking the same for conformity with the design concept of the work as established in the Contract Documents, and is not intended to be for the purpose of determining the accuracy of other matters that may be contained in such submittals, including, but not limited to such matters as dimensions, quantities, performance of equipment and systems designed by the Contractor, Contractor-furnished engineering and design, construction means, methods, techniques, sequences, procedures or safety precautions, the correctness of which as set forth in the Contract Documents or submittal shall be the sole responsibility of the Contractor.

Flag all deviations on the shop drawings from the specified item and approval of the shop drawings will not be considered acceptance of the deviation unless it’s been explicitly flagged.

Where any specific equipment, materials, process or method of construction is specified by name or by reference to the catalog number of a manufacturer, the specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the drawings.

OPERATION & MAINTENANCE MANUALS
Submit operation and maintenance manuals following Section specific shop drawing submittal guidelines. Upon completion of all work and tests, the Plumbing Contractor shall furnish the necessary qualified personnel for operating the systems as directed by and scheduled with the Architect and the Owner. At this time, the Contractor shall instruct the Owner or his representative in the operation, adjustment and maintenance of all equipment furnished.

Three (3) maintenance manuals shall be submitted, which shall present full details for the care, maintenance, and operation of all equipment and systems.

Provide documentation in the operation and maintenance manual that a smoke test was applied to the drain and vent system as specified in this Section.

Provide documentation that the water distribution piping was flushed as specified in Section 22 05 00.

Record Plans:
Record drawings shall be kept daily, noting all changes and available upon demand. These drawings shall be made on electronic files or Owner’s office field set of drawings.

QUALITY ASSURANCE
All materials, equipment, and parts shall be new and unused of current manufacture.

Provide all necessary accessories required for a complete and operable system.

WARRANTY
The Work of this Division shall be guaranteed, in writing, to be free from defects in materials and/or workmanship for one (1) year from the date of certificate of completion and acceptance of the work. Necessary instruction and/or emergency services to be performed as a result of defects in materials or workmanship shall be furnished for one (1) year at no extra cost for labor or materials. If default thereof, the Owner may have such work done and charge all applicable costs to the Contractor.

Furnish manufacturer’s written warranties on all equipment to the Owner stating effective date of warranty.

PART 2 - PRODUCTS
GENERAL

It is the intent of these specifications that all the necessary material, apparatus, and devices to complete the installation as specified herein, except such parts as are specifically excepted, shall be provided.

If an item is either shown on the plan or called for in these specifications, it shall be considered sufficient of said item in this contract.

All sizes given are as minimum.

Material and labor shall be first class and workmanlike and to the satisfaction of the Plumbing Engineer and shall be subject to inspection test and approval at all times from commencement until acceptance of completed work.

Manufacturers shall be responsible for providing material listed by U.L. or other approved agencies, and all governing codes and ordinances.

All material must bear U.L. and/or other approved labels where possible.

Items specified by catalog number or brand name and approval of shop drawings will not relieve the manufacturer of this responsibility.

TEMPORARY UTILITIES AND TOILETS

Water: As soon as possible, install permanent water mains into new building, provide temporary gate valve and freezing protection, extend piping and provide a ¾" hose bibb located where directed for use by all Contractors. Permanent lines may be used for temporary service.

Contractors shall prevent waste of cold water. The Plumbing Contractor shall maintain valves and connections in perfect condition at all times. Each Contractor shall provide his own hose or piping from hose bibbs.

The Owner will pay cost of cold water used only. Contractors requiring hot water for construction must make provisions to heat same.

Sewer: Immediately after award of contract, Plumbing Contractor shall make arrangements to begin underground sewer work and shall complete sewer work, including backfilling required, as soon as possible.

Pumps and temporary connections required for pumping water from building and excavations shall be provided by Contractor requiring same to protect his work and to allow continuation of his work to assure conformance with the progress schedule.

Each Contractor shall remove his pumps and connections required to maintain his work.

The General Contractor shall provide approved and adequate temporary toilet facilities for all trades.

PART 3 - EXECUTION

EXAMINATION

Verify equipment is in compliance with approved submittal drawings.

FIELD MEASUREMENTS

Field verify all measurements. Do not base on contract drawings.

Identify conflicts with the work of other trades prior to installation of work.

Adjust system to satisfy field requirements.
DELIVERY, STORAGE AND HANDLING

Receive, sign for and store all equipment in this section.

Maintain original quality and condition of equipment while it is in storage.

INSTALLATION

General:

The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.

Install all materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

Visit to the site:

Prior to submitting a bid, bidders are required to visit the premises, take measurements, verify all elevations shown on the plans, and inspect existing conditions and limitations. No extras will be allowed because of misunderstandings as to the work involved in this or other Divisions.

Diagrams, Measurements, Final Layout Plans:

Plans show the layout in general and approximate locations of piping, major equipment, etc., and shall be followed as closely as the actual construction of the building, work of other trades, and the locations of equipment will permit.

All changes from the plans necessary to make the work of this Division conform to the building as constructed and to fit the work of other trades shall be made without extra cost.

Drawings for this Division of the Work shall not be scaled for exact dimensions. Consult the architectural and structural drawings and details for all dimensions and location of plumbing fixtures.

Protection of Finished Work and Materials:

Protect all materials and work performed under this Division from damage or injury that may be caused by other workmen and from the action of the elements.

Protect the materials and work performed by other Divisions, and the Owner’s property from damage or injury arising from Work in this Division.

Keep all piping and equipment capped, plugged, drained, or otherwise protected including protection from freezing and by stoppage from building materials, sand or dirt, mortar, concrete, etc.

Cleaning and Finishing:

After all tests have been made and the system pronounced tight and satisfactory, the Contractor shall go over all his work and clean equipment, fixtures, piping, etc. and leave clean and in complete working order at final completion of the building.

The putting of new work, or any part thereof, into use, even though with the Owner’s consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor shall it be construed to obligate him, in any way, to accept improper work or defective material.

Cooperation with Other Divisions and the Owner:

Give full cooperation to other trades and furnish any information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.
The Work of this Division must be coordinated with the work of other Divisions and the Owner to prevent interference. Any necessary changes to be made because of the lack of proper coordination shall be performed without extra charge.

Where the work of this Division will be installed in close proximity to the work of other trades, or where there is evidence that the work of the Contractor will interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment.

If the Contractor installs his work before coordinating it with other trades, he shall make necessary changes in his work to correct the condition without extra charge.

Provide all service connections under the jurisdiction of this Division to Owner’s equipment or equipment furnished by other Divisions as required for a complete and operating installation.

Supervision:
Furnish the services of an experienced superintendent who shall be constantly in charge of all the work included in or related to this Division.

Testing:
All piping systems installed under Work of this Division shall be tested prior to painting, backfilling, installation of pipe covering, or concealment within the building construction.

All tests shall be conducted in the presence of and to the satisfaction of the inspector having jurisdiction.

Testing shall be conducted in accordance with the Wisconsin Uniform Plumbing Code or as hereinafter specified. Repair any leaks that occur during testing, and retest until no leaks occur.

The sewer, drain, vent and conductor piping system shall be tightly closed and filled with water to the highest opening. The water shall be kept in the system for at least 15 minutes before inspections start. An air test of 5 pounds per square inch for a period of 15 minutes is also acceptable. The smoke test does not take the place of the water or air test.

After the sanitary drain and vent system has been completed, but before the finished ceiling grid is installed, the Plumbing Contractor shall have a smoke test done on the entire drain and vent system. The testing shall be done by a company regularly engaged in the smoke testing of sewer, drain, and vent piping, such as American Leak Detection of Hartland, Wisconsin, phone 262-538-5000 or 866-570-5325. Smoke shall be introduced into the system with the main sanitary building sewer sealed. Each roof penetration shall be sealed as smoke appears to pressurize the system. The Plumbing Contractor shall inspect the entire drain and vent system for leaks and traps that are not sealed before the smoke test is removed. The smoke test shall be witnessed by the Owner’s representative and a report that a successful test was conducted shall be included in the operation and maintenance manual.

The interior water distribution system shall be tested and proved watertight under a water pressure not less than 150 PSI for a period of two hours.

Conduct a test on each reduced pressure backflow preventer prior to it being put in service.

Demolition:
Disconnect and remove fixtures, along with related drain, vent and water piping in areas that are to be remodeled, and cap back at active mains.

All abandoned drain, vent, water and gas piping above existing ceilings shall be disconnected and removed from the site.
Cap waste, vent, and water piping in walls, floors, or ceilings as necessary to comply with the State of Wisconsin Uniform Plumbing Code.

Remove floor drain traps and cap sanitary waste pipe with a cast brass plug. Using cement mortar to seal abandoned floor drains will not be permitted.

All caps/plugs required to seal existing drain, vent, and water piping shall be cast brass or copper.

Any other materials necessary for demolition shall comply with Section 22 05 00.

Substitution of Equipment:

All costs, as a result of the approval of substituted items by the Architect or Engineer, including costs required under other Contracts, shall be the responsibility of the Contractor requesting the substitution. None of the extra costs resulting from such approval shall evolve upon the Owner, the Architect, other Consultants, or other Contractors.

OWNER TRAINING (NONE)

SPARE EQUIPMENT (NONE)

* * * * *
SECTION 22 05 00
BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work under this Section.

DESCRIPTION OF WORK
Furnish and install a complete and operable mechanical system as indicated on the drawings and as specified herein.

Materials:
- Materials shall conform to the standard prescribed in the Wisconsin Uniform Plumbing Code and be approved for use by the Department of Safety and Professional Services, Division of Technical Services.
- When required, Plumbing Contractor shall obtain approval prior to installation.
- All materials and equipment required for the work shall be new, of first-class quality and shall be furnished, delivered, erected, connected and finished in every detail and shall be so selected and arranged as to fit into the building spaces.

Materials Not Included:
- Toilet partitions and toilet room accessories including, but not limited to paper holders, soap dishes, towel bars, grab bars, barrier free shower seats, etc.

SHOP DRAWINGS
Submit electronic files with dimensions, capacities, and information as soon as available from manufacturers.

QUALITY ASSURANCE
All materials, equipment, and parts shall be new and unused of current manufacture.

Provide all necessary accessories required for a complete and operable system.

WARRANTY
Materials and workmanship shall be warranted for a period of not less than (1) year from the date of commissioning against defects in material and workmanship.

The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).
**DRAIN AND VENT SYSTEMS**

Sanitary building sewer shall be of service weight cast iron conforming to ASTM A74 standards or plastic pipe conforming to ASTM D2665 or D3034 standards. Lines 8” and larger may be plastic pipe conforming to ASTM D1785 standards. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

Storm building sewer shall be cast iron conforming to ASTM A74 standards, plastic pipe conforming to ASTM D2665, ASTM 3034 or ASTM D1785 standards, as applicable. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

Sanitary and storm sewer lines that penetrate exterior poured concrete foundation walls shall be cast iron to 5 foot beyond wall or shall be installed through a sleeve 2 inches larger than the outside diameter of the pipe.

Underground sanitary drain and vent piping and fittings within the building shall be service weight cast iron conforming to ASTM A74 standards or PVC plastic pipe and fittings conforming to ASTM D2665 standards. Lines 8” and larger may be plastic pipe and fittings conforming to ASTM D1785 standards. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

Underground storm drain piping and fittings within the building shall be service weight cast iron conforming to ASTM A74 standards or plastic pipe conforming to ASTM D2665 standards. Lines larger than 8” may be plastic pipe conforming to ASTM D1785 standards. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

Above ground waste, conductor, clear water and vent piping and fittings within the building shall be no-hub cast iron, Schedule 40 plastic pipe conforming to ASTM D2665 standards, copper or galvanized steel pipe. Any plastic piping installed in ceiling plenums shall be polyvinylidene fluoride (PVDF) and shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84 or UL 723. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

**JOINTS FOR DRAIN AND VENT PIPING**

Cast iron pipe shall have hub and spigot joints with neoprene gaskets underground and no-hub with Mission, or equal, heavy weight couplings above ground.

Copper pipe shall have 50-50 solder joints soldered with paste flux, joints mechanically cleaned before soldering. Use wrought copper or brass fittings.

Steel galvanized pipe shall have screwed joints with non-toxic pipe joint compound applied to male threads only.

Plastic pipe shall have solvent solder joints. Solvent to be NSF approved and be compatible with material being used. Use heavy body solvent for large diameter fittings. Primer shall conform to ASTM F656 standards. Solvent cement shall conform to ASTM D2564 standards.

**WATER DISTRIBUTION SYSTEM**

Branch valves shall be cast iron, mechanical joint conforming to A.W.W.A. C-500 specifications suitable for direct burial.

Road boxes shall be of the Arch or Minneapolis Pattern, made with cast iron, maximum length of 7’ and telescoping top section.

Underground pipe 2 ½” and smaller shall be as follows:

Type K soft tempered copper pipe with flared cast brass union type fittings designed for underground use.
Above ground piping within the building shall be as follows:

Type “L” hard copper with wrought copper sweat fittings. Joints shall have 95-5 solder and made with lead free paste flux mechanically cleaned before soldering. Copper mechanical grooved fittings and couplings or rolled grooved pipe 2 ½” or larger may be used in lieu of soldered fittings. Mechanically formed brazed tee connections on piping 2 ½” and larger may be used in lieu of specified tee fittings for branch take-offs up to one-half the diameter of the main. A pro press water distribution system shall not be included in the base bid. If the Contractor desires to use a pro press water distribution system, an informational bid shall be included.

**VALVES**

Provide all valves of figures, types and number throughout the entire plumbing installation as specified. Valves of reputable manufacturers such as Nibco, Milwaukee, Hammond, Watts, Apollo, or equal will be acceptable. The manufacturer’s name and valve number shall be cast into the body of the valve. **All potable valves shall meet the Wisconsin Lead Free Act for 2014.**

In general, all valves shall be of standard dimensions and suitable for a minimum 150 lbs. working pressure. Provide ball valves for piping 2 ½” and smaller and gate or butterfly valves for piping 2” and larger.

Ball valves shall be similar to Nibco #S-585-Y-LF for piping 1½” and smaller and Nibco #S-595-Y-LF for piping larger than 1½”. Ball valves shall have extended tee handle to prevent any interference with the pipe insulation.

Balancing valves shall be calibrated circuit setters equal to Bell & Gossett CB Lead Free Circuit Setter Plus Calibrated Balance valves

**THERMOMETERS**

Provide water thermometers at water heater, storage tanks, recirculating lines and blending valve.

Thermometers of reputable manufacturers such as Trerice or Marsh are acceptable.

Thermometers shall be similar to Trerice vapor actuated dial thermometers with 4 ½” dial and 40º to 240ºF range.

**UNIONS AND FLANGES**

Provide unions or flanges for all backflow preventers, check valves, water heater connections, or wherever is required for proper piping and equipment installation. Provide insulating dielectric type unions or flanges with isolation kits between pipe of dissimilar metals.

**TRAPS**

Provide cast iron or Schedule 40 PVC plastic deep seal “P” traps with threaded drain plug for traps above grade.

Traps below grade shall be same less drain plug.

Traps for sinks, lavatories, etc., shall be 17 gauge chrome plated with removable dip tube or screw plug.

Solids traps at art room sinks shall be supported with a PVC sleeve.

Contractor shall fill all traps in science rooms and mechanical equipment rooms with a vegetable oil, mineral oil, propylene glycol or glycerin to reduce trap seal evaporation

**VENT FLASHINGS**

Provide an approved watertight vent flashing where the roof system is penetrated by a vent terminal.

Vent flashings shall be 3 lb. sheet lead, 8 oz. sheet copper or EPDM, neoprene, TPO or hypalon material approved by the State of Wisconsin Uniform Plumbing Code. Vent flashing shall be compatible with the type of roof system used.
HANGERS, ANCHORS AND INSERTS

All piping in the plumbing system shall be supported with hangers in accordance with the provisions of the Wisconsin Uniform Plumbing Code.

Provide hangers and accessories as manufactured by B-Line, Anvil, Fee & Mason, or Elcen. Clevis type for horizontal piping.

The use of perforated strap hangers will not be acceptable.

Use approved malleable, wrought iron or steel pipe riser clamps for steel or cast iron lines and copper plated clamps for copper tubing.

Provide all necessary inserts for supporting piping and equipment.

Plastic piping shall be supported with plastic coated clevis hangers at intervals recommended by the manufacturer.

Provide low compressive insulation protector on all insulated plumbing pipes 1½” diameter or larger. Protective shield shall be galvanized carbon steel.

Use non-metallic glass reinforced polyurethane hangers, thread rod and nuts to support plumbing piping systems in the pool area and pool equipment rooms.

SUPPORTS

Provide all structural supports required for equipment included under this Division of the Work.

WATER HAMMER ARRESTERS

Provide water hammer arresters conforming to ASSE 1010 standards at all quick-closing valves and at other locations in the piping system as may be required to accomplish noiseless operation of the system under all operating conditions. All water hammer arresters must be exposed or accessible by means of access panels.

Provide Precision Plumbing Products, Josam, J.R. Smith, or Sioux Chief, water hammer arresters.

ESCUTCHEONS

Provide on all pipes passing through finished floors, walls and ceilings with outside diameter sufficient to cover sleeve opening and inside diameter to fit snugly around pipe.

Escutcheon plates shall be chrome plated brass.

ACCESS PANELS

Provide access panels of required sizes and types as required for access to all cleanouts, valves, traps, water hammer arresters, etc.

Panels shall be as manufactured by KARP and Associates, Milcor, or Titus with key locking device.

Panels shall be installed by Plumbing Contractor in openings provided by the General Contractor as located and supervised by this Division.

VALVE AND PIPE IDENTIFICATION

All equipment, valves, starters, etc., must be identified as listed below.

All piping in this Division of the Work exposed, in access spaces or above ceilings shall be identified at minimum of 25' intervals and at least once in every room with W.H. Brady Co., Seton, or equal, pipe marking labels, 2¼” color as required by A.N.S.I. standards.
Valve tags shall be 1 1/8" round brass tags with black numerals. Fasten tags to body of valves with copper or brass chain. Numerals on tags shall correspond to the record drawings.

Equipment and starters shall be identified with neat, clear, permanent labels.

Identify all welding gas piping with W.H. Brady Co., Seton or equal, pipe marking labels.

Charts:

- Furnish three (3) charts listing all valves, giving their location in the building and describing the valve number, service, function, normal position, etc. One (1) chart encased in plastic to be mounted in the building maintenance office and the other two (2) charts delivered to the Architect for transmittal to the Owner.

- Furnish one (1) overall floor plan showing the location of all water distribution valves and the corresponding number from the valve chart.

**PIPE SLEEVES**

- Provide sleeves for pipes passing through masonry or concrete walls and floors, seal all openings between pipe and sleeve with vinyl acrylic plastic. For piping passing through fire walls, floors or ceilings, use 3-M Fire Barrier CP-25 caulk and 303 putty synthetic elastomers, U.L. rated.

- Sleeves for pipes passing through floors outside of chases shall be constructed of galvanized steel pipe (black steel pipe through structural beams) ½" larger than pipe or pipe covering and shall extend ½" above finished floors.

- Provide 20 gauge galvanized iron sleeves 1" larger than the outside diameter of pipe and of sufficient length to pass through walls, partitions, etc., for piping exposed to view.

**PART 3 - EXECUTION**

**EXAMINATION**

- Verify equipment is in compliance with approved submittal drawings.

**FIELD MEASUREMENTS**

- Field verify all measurements. Do not base on contract drawings.

- Identify conflicts with the work of other trades prior to installation of work.

- Adjust system to satisfy field requirements.

**DELIVERY, STORAGE AND HANDLING**

- Receive, sign for and store all equipment in this section.

- Maintain original quality and condition of equipment while it is in storage.

**INSTALLATION**

**Excavation And Backfill**

- Excavating and backfill as defined in Section 31 23 00 takes precedence over statements made in this section should any conflicts occur.

- Contact public utilities and the building’s maintenance personnel to determine locations of their underground installations and avoid confliction therewith. Underpin and support all lines. Cut off service connections encountered which are to be removed at the limits of fire excavation and cap. In the event relocation of sewer and water services are necessary to avoid this conflict, the Architect shall be consulted.
Erosion Control: Contractor to provide layout for erosion control, which will be used during excavation of trenches, etc. for utilities to be installed by Plumbing Contractor. Erosion Control to be installed in accordance with requirements of authorities having jurisdiction, or in the absence of regulatory authority, layout to be approved by Owner/Architect.

Make all necessary excavations for water service, storm and sanitary sewers, lift station, manholes, catch basins, sumps, etc. Excavate to bottom of pipe and structure bedding, 4” in stable soils 6” in rock or wet trenches and 8” in unstable soil. Finish bottoms of excavations to true, level surface.

Strip topsoil from area to be excavated, free from subsoil and debris, and store for later respreading.

At no time place excavated materials where it will impede surface drainage unless such drainage is being safely rerouted away from the excavation or work of other trades.

Excavate whatever materials are encountered as required to place at the elevations shown; all pipe, manholes and other work. Remove debris and rubbish from excavations before placing bedding and backfill material.

Provide and maintain all fencing, barricades, signs, warning lights, and/or other equipment necessary to keep all excavation pits and trenches and entire subgrade area under all circumstances and at all times. No excavation shall be left unattended without adequate protection.

Elevations shown on the plans are subject to such revisions as may be necessary to fit field conditions.

Install lines passing under foundations with minimum of 1 ½” clearance to concrete and insure there is no disturbance of bearing soil. Care must be taken in excavation that the walls and footings will not be disturbed in any way.

Excavated materials from areas under sidewalks, drives, parking areas, municipal streets or new building construction shall be removed from the site unless otherwise specified.

Tunnel or remove sidewalk and curb in areas of excavation to the nearest joint. Remove pavements, curbs and gutters to neat and straight lines to the limits of removal. Make sawcut lines parallel to existing joints, or parallel or perpendicular to pavement edges to form a neat patch. Carefully remove remaining pavement within the sawcut area. Leave existing base materials between the area disturbed by the work and the sawcut line undisturbed by the sawcutting, pavement removal or pavement replacement processes.

Bedding:

   Bedding up to a point 12” above the top of the pipe shall be thoroughly compacted sand or crushed stone chips.

Backfill:

   Backfill with clean crushed bank run sand or gravel inside the building and below sidewalks, drives, or parking areas. Place backfill in layers not more than 8” in loose depth, compacting each layer to required maximum density. Do not place backfill material on surfaces that are muddy, frozen, or contain ice or frost. All backfill materials shall be vibrator compacted.

   Place and compact acceptable backfill materials in layers to required elevations. Backfill materials shall be free of clay, rock debris, vegetable matter, waste and frozen materials. Use sub-base material where indicated under piping or conduit; shape to fit bottom 90 degrees of cylinder.
Compaction:
Compact each layer of backfill to 90% maximum density for cohesive soils and 95% relative density for cohesionless soils; at lawns or unpaved areas, 85 maximum density for cohesive soils and 90% relative density for cohesionless soils or requirements of Section 31 23 00 which takes precedence if requirements are more strict.

Perform and pay costs of field density tests in accordance with Section 31 23 00 of the specifications.

Surface Restoration:
Completely restore the surface of all disturbed areas to a like condition of the surface prior to the work.
Level off all waste disposal areas and clean up all areas used for the storage of materials or the temporary deposit of excavated earth. Remove all surplus material, tools and equipment. Replacement of all existing slabs, curbs, etc. removed to install utilities by Plumbing Contractor must be replaced to match existing.

Sheeting, Shoring and Bracing:
Provide shoring, sheet piling and bracing in conformance with the Wisconsin Administrative Code to prevent earth from caving or washing into the excavated earth. Shore and underpin to properly support adjacent or adjoining structures. Abandon in place shoring, sheet piling and underpinning below the top of the pipe, or if approved, in advance by the engineer, maintained in place until other permanent support approved by the engineer is provided.

Dewatering:
Provide, operate and maintain all pumps and other equipment necessary to drain and keep all excavation pits, trenches and the entire subgrade area free from water under all circumstances.

Rock Excavation:
Remove rock encountered in the excavation to a minimum density of six (6) inches outside the pipe. Rock excavation includes all hard, solid rock in ledges, bedded deposits and unstratified masses, all natural conglomerate deposits so firmly contented as to present all the characteristics of solid rock; which material is so hard or so firmly cemented that in the opinion of the Engineer it is not practical to excavate and remove same with a power shovel except after thorough and continuous drilling and blasting. Rock excavation includes rock boulders of 2 cubic yard or more in volume.

Rock excavation will be computed on the basis of the depth of rock removed and a trench width two (2) feet larger than the outside diameter of the pipe where one (1) pipe is laid in the trench and three (3) feet larger than the combined outside diameter where two (2) pipes are laid in the trench. Include 6" pipe and structure bedding in rock excavation. Include rock excavation shown on the plans in the Base bid.

Cutting And Patching
All cutting and patching that may be necessary for the installation of the system specified shall be done and repaired by this Division under the direction and to the satisfaction of the Architect. No cutting of structural work shall be done without the written consent of the Architect, and all such work shall be done in accordance with the Architect’s directions and under his supervision.

Holes through precast concrete floors shall be rotary or core drilled in strict accordance with the manufacturers recommendations.

Plumbing Contractor shall saw-cut and remove concrete in existing areas as required for new installations. Plumbing Contractor shall have the General Contractor replace floors as required, but the cost shall be included in the plumbing bid.
Plumbing Contractor shall remove existing wall and ceiling areas as required for new installations. In unfinished areas, Plumbing Contractor shall repair existing walls to the satisfaction of the Architect. In finished areas, the Plumbing Contractor shall have the General Contractor repair existing walls and ceilings as required, but the cost shall be included in the plumbing bid.

Installation Of Drain And Vent Piping
Verify existing and proposed sewer elevations and locations in the field and notify the Architect, in writing, of any variances before any sewer work is begun.

Sewers shall be laid on 4” of bedding sand or pea gravel to support pipe evenly and avoid hubs supporting piping. All installations shall be constructed in an approved manner to the complete satisfaction of the Architect and Plumbing Inspector.

Connections to the sewer at the base of all stacks or vertical lines shall be made with long sweep ¼ bends, two 1/8 bends, or a “Y” and 1/8 bend combination. All changes in direction of soil or waste pipe shall be made by means of suitable bends, and where possible, “Y” and 1/8 bend combinations shall be used instead of quarter bends.

All horizontal waste piping 3” and smaller must have a slope at ¼” per foot and 4” and larger not less than 1/8” per foot unless otherwise specified.

Vent terminals shall penetrate the roof system of a building full size, but not less than 3”.

All horizontal vent lines must be graded so as to drain to the soil or waste piping.

Avoid locating waste or vent piping over electrical equipment or in elevator equipment rooms.

Cleanouts shall be provided 28” to 30” above the base of every soil, conductor or waste stack, wherever there is a change in direction of run of soil or waste pipe, and elsewhere as may be shown on the drawings or required by the Wisconsin Uniform Plumbing Code.

Cleanouts shall be extended to the top of floor or to the face of walls and shall be capped with access covers as hereinafter specified or scheduled on the drawings. Cleanouts shall be installed to the side of corridors and rooms.

Installation Of Piping Within A Plenum Ceiling
Plumbing within the plenum ceiling shall be of non-combustible material or shall have a flame spread index of not more than 25 and a smoke–developed index of not more than 50 when tested in accordance with ASTM E84, CAN/ULC S102.2 or UL 723 with the exception of combustible materials fully enclosed within continuous noncombustible raceways or enclosures, or within materials listed and labeled for such application.

Installation Of Water Piping
Conceal all piping whenever possible. Bring stub extensions as close to fixtures as possible. Install all piping so that it can be drained, and provide a brass drain plug at low points and at the bottom of risers.

Avoid locating any water piping over electrical equipment or in elevator equipment rooms.
Piping shall be sterilized according to the Standards of the Wisconsin Administrative Code.

Before any newly constructed water supply piping 3” and smaller is to be put into use, the system shall be filled with water and allowed to stand for at least 24 hours. After 24 hours, each water outlet shall be flushed beginning with the outlet closest to the building control valve and then each successive outlet in the system. The flushing at each water outlet shall continue for at least one minute and until the water appears clear at the outlet. Documentation that the water distribution piping has been flushed shall be included in the operations and maintenance manual.

Electrical Coordination

All wire, conduit and other devices required for the control of plumbing equipment shall be furnished by the Electrical Contractor.

Electrical Contractor will provide all power wiring and control wiring to all motors, control cabinets, aquastats, etc. necessary for the plumbing system.

Furnish wiring diagrams to Electrical Contractor for all equipment and devices furnished by this Contractor and indicated to be wired by the Electrical Contractor.

OWNER TRAINING (NONE)

SPARE EQUIPMENT (NONE)

* * * * *
SECTION 22 05 05
THROUGH-PENETRATION FIRESTOPPING

PART 1 - GENERAL

DESCRIPTION OF WORK

Contractor (EC, MC, PC or FPC) shall reference specification Division 07 for all firestopping materials and requirements.

All penetrations through fire and/or smoke rated walls required by this contractor shall be done by utilizing sleeves or openings dedicated to the contractor’s systems. This contractor shall coordinate with the Firestopping Contractor to ensure that the sleeve, conduit, or opening fill is not exceeded for the planned firestopping system. Do not share sleeves, openings, or penetrations that require firestopping with other trades.

All firestop materials shall be furnished and installed by a dedicated Firestopping Contractor, costs for which shall not be born by this contractor.

The intent is that this contractor shall identify and coordinate all penetrations through fire barriers with the Firestopping Contract.

The contractor (EC, MC, PC or FPC) shall indicate what type of material, system, or product will penetrate each fire/smoke rated assembly to ensure that there is a UL Listed firestop assembly that will restore the listed fire/smoke rating to the element being penetrated.

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SECTION 22 07 00
PLUMBING INSULATION

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification, apply to work under this Section.

DESCRIPTION OF WORK
Furnish and install a complete and operable insulation system as indicated on the drawings and as specified herein.

Provide and install insulation for horizontal rain conductors, roof drain bowls, cold water, hot water, and hot water return piping complete.

Quality Assurance:
All work shall be performed by skilled tradesmen regularly engaged in this work.

All spaces, equipment, piping, ductwork, etc., shall be protected from dropping of insulation materials.

Leave all areas in a clean and orderly condition.

Insulation to have flame rating of 25 or less and shall not melt or drip when exposed to flame.

Insulation in active supply and return air plenums to have a smoke developed rating of 50 or less.

SHOP DRAWINGS
Submit electronic files of drawings with dimensions, capacities, and information as soon as available from manufacturers.

QUALITY ASSURANCE
All materials, equipment, and parts shall be new and unused of current manufacture.

Provide all necessary accessories required for a complete and operable system.

WARRANTY
Materials and workmanship shall be warranted for a period of not less than 1 from the date of commissioning against defects in material and workmanship.

The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

PRODUCTS
Insulation materials shall be manufactured by Armstrong, Certainteed, Manville, Knauf, Owens-Corning, or equal.
Insulate all cold water lines with ½” thick fiberglass insulation with ASJ/SSL jacket and maintain a continuous vapor barrier.

Insulate all 120 degree hot water and 120 degree hot water return piping with 1” thick fiberglass insulation with ASJ jacket.

Insulate all horizontal rain conductors with 1” thick fiberglass insulation with ASJ/SSL jacket and maintain a continuous vapor barrier.

Insulate roof drain sumps with Armaflex II sheet insulation and Armstrong 520 adhesive.

Insulate exposed vertical conductors with ½” thick fiberglass insulation with ASL/SSL jacket. Maintain a continuous vapor barrier and cover insulation with .016” PVC jacketing.

**PART 3 - EXECUTION**

**EXAMINATION**
Verify equipment is in compliance with approved submittal drawings.

**FIELD MEASUREMENTS**
Field verify all measurements. Do not base on contract drawings.

Identify conflicts with the work of other trades prior to installation of work.

Adjust system to satisfy field requirements.

**DELIVERY, STORAGE AND HANDLING**
Receive, sign for and store all equipment in this section.

Maintain original quality and condition of equipment while it is in storage.

**INSTALLATION**
Do not apply insulation to any piping until it has been tested and accepted.

Apply all materials in conformance with manufacturer’s recommendations.

Insulate all above ground water piping valve bodies, fittings, unions, and miscellaneous surfaces with mitered sections of insulation equal in thickness and premolded PVC fittings.

All joints shall be tight with insulation lengths tightly butted against each other.

All cuts shall be smooth and square and without breakage of end surfaces.

Adhesive shall be non-flammable solvent base, synthetic rubber type.

Adhesive shall be used on cold water and horizontal conductor lines. Outward clinch staples may be used on hot water piping at 3” intervals.

Provide a 3” sand bedding for underground insulated piping and backfill with sand to a minimum of 3” over pipe insulation.

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SECTION 22 14 23
DRAIN TILE

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work under this Section.

DESCRIPTION OF WORK
Furnish and install a drain tile system where shown on the plumbing plans and as described in this Section.

Included herein is everything necessary for, or incidental to, completing all foundation drainage systems and related work and materials as herein specified and shown on the drawings.

Foundation drainage work includes the following:
Outside and inside footing drainage system, including bleeders.
Connections of drain tile to clear water sump pump.

SHOP DRAWINGS
Submit electronic files of drawings with dimensions, capacities, and information as soon as available from manufacturers.

QUALITY ASSURANCE
All materials, equipment, and parts shall be new and unused of current manufacture.

Provide all necessary accessories required for a complete and operable system.

Certification: Submit Certification signed by foundation drainage system installer that installed materials conform to specified requirements and system was successfully checked and tested prior to covering with filtering and drainage fill.

WARRANTY
Materials and workmanship shall be warranted for a period of not less than 1 year from the date of commissioning against defects in material and workmanship.

The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

DRAINAGE PIPE AND FITTINGS
Furnish drainage pipe complete with bends, reducers, adapters, couplings, collars and joint materials.
Outside and inside foundation drainage pipe shall be perforated corrugated polyethylene tubing; 4” diameter; heavy duty type; wrapped with a synthetic drainage fabric.

Furnish joint screening for each open-joint portion of drain lines.

Provide bleeders through footings at 8’0” on center.

SOIL MATERIALS

Impervious Fill: Clayer gravel and sand mixture capable of compacting to a dense composite

Drainage Fill: Evenly graded mixture of natural or crushed gravel, crushed stone and natural sand with 100% passing a ½” sieve and 0-5% passing a #50 sieve.

Filtering Material: Evenly graded mixture of natural or crushed gravel, crushed stone and natural sand with 100% passing a 1½” sieve and 0-5% passing a #50 sieve.

PART 3 - EXECUTION

EXAMINATION

Verify equipment is in compliance with approved submittal drawings.

FIELD MEASUREMENTS

Field verify all measurements. Do not base on contract drawings.

Identify conflicts with the work of other trades prior to installation of work.

Adjust system to satisfy field requirements.

DELIVERY, STORAGE AND HANDLING

Receive, sign for and store all equipment in this section.

Maintain original quality and condition of equipment while it is in storage.

INSTALLATION

Impervious Fill at Footings:

After concrete footings have been cured and forms removed, place impervious fill material on sub-grade adjacent to footing. Place and compact impervious fill to dimensions not less than 6” deep and 12” wide.

Filtering Material:

Place supporting layer of filtering material over compacted sub-grade where drainage pipe is to be laid to a compacted depth of not less than 6”.

After testing drain lines, place additional filtering material to a 6” depth around sides and top of drains.

Laying Drain Pipe:

Lay drain pipe solidly bedded in filtering material. Provide full bearing for each pipe section throughout its length, to true grades and alignment and continuous slope in direction of flow.

Lay perforated pipe with perforations down and joints tightly closed in accordance with pipe manufacturer’s recommendations. Provide collars and couplings as required.

Connect drain tile system to clear water sump pump with 4” PVC pipe.

Connect drain tile system to elevator sump pump with 4” PVC pipe.
Testing Drain Lines: Test or check lines before backfilling to assure flow. Remove obstructions, replace damaged components and retest system until satisfactory.

Drainage Fill: Place drainage fill over drain lines after satisfactory testing and covering of drain lines with filtering material. Completely cover drain lines to a width of at least 6” on each side and above top of pipe. Place fill material in layers not exceeding 3” in loose depth and compact each layer placed.

Overlay drainage fill material with one layer of synthetic drainage fabric, overlapping edges at least 4”.

OWNER TRAINING

Provide minimum of one hour training on equipment operation.

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SECTION 22 42 00
COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work under this Section.

DESCRIPTION OF WORK
Furnish and install a complete and operable plumbing system as indicated on the drawings and as specified herein.

Provide and install plumbing fixtures, drains, hose bibbs, cleanouts, etc. where shown on the plans and as hereinafter specified.

All plumbing fixtures furnished for this project shall comply with the State of Wisconsin Water Conservation Standards as specified in Chapter Comm. 84.20 of the Wisconsin Uniform Plumbing Code.

All faucets shall be constructed from a lead-free brass alloy, and where used in drinking water applications, shall be certified to be NSF61, Section 9 compliant.

SHOP DRAWINGS
Submit electronic files of drawings with dimensions, capacities, and information as soon as available from manufacturers.

QUALITY ASSURANCE
All materials, equipment, and parts shall be new and unused of current manufacture.

Provide all necessary accessories required for a complete and operable system.

WARRANTY
Materials and workmanship shall be warranted for a period of not less than 1 from the date of commissioning against defects in material and workmanship.

The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

MANUFACTURERS
Plumbing fixtures as manufactured by Kohler, Sloan, American Standard or Zurn.
Brass products as manufactured by Zurn, McGuire or Brasscraft.
Electric water coolers as manufactured by Elkay, Haws or Halsey Taylor.
Faucets as manufactured by Chicago Faucet, Kohler Brass, Zurn Brass, Speakman Brass or Moen Commercial.

Flush valves as manufactured by Sloan, Zurn or American Standard.

Floor and wall cleanouts as manufactured by Schier, J.R. Smith, Josam, Zurn or Watts.

Floor drains as manufactured by Sioux Chief, J.R. Smith, Josam, Zurn or Watts.

Roof drains as manufactured by J.R. Smith, Josam, Zurn or Watts.

Hose bibbs as manufactured by Woodford, Chicago or Zurn.

Mop basins as manufactured by Fiat, Acorn or Stern Williams.

Insulation kits for barrier free lavatories and sinks as manufactured by Truebro, Inc., Zurn, Brocar Products Inc., Pro Wrap or Insul-Guard.

Water closet seats as manufactured by Bemis, Olsonite or Church.

FINISHES

All fixture colors to be white and finish to be chrome plated unless otherwise specified.

Wall cleanouts to have flush stainless steel trim plate. Floor cleanouts to have nickel bronze covers.

PLUMBING FIXTURE LIST

See plumbing fixture schedule on drawing P1.

PART 3 - EXECUTION

EXAMINATION

Verify equipment is in compliance with approved submittal drawings.

FIELD MEASUREMENTS

Field verify all measurements. Do not base on contract drawings.

Identify conflicts with the work of other trades prior to installation of work.

Adjust system to satisfy field requirements.

DELIVERY, STORAGE AND HANDLING

Receive, sign for and store all equipment in this section.

Maintain original quality and condition of equipment while it is in storage.

INSTALLATION

Floor Drains

Drains shall have “P” trap same size as drain. Set top perfectly level and at height to allow proper pitch of floors toward drain as scheduled on the drawing.

Provide safing material conforming to SPS 384.30(6) extending a minimum 12” beyond drain at all floor drains over excavated areas.
Roof Drains
Flash with 4 lb. sheet lead extending from clamping ring to 18” beyond outside rim of drain. Flashing shall
be set on soft roofing cement before Roofing Contractor applied roof coatings (Applies to built-up roofs).
For membrane roofs, Plumbing Contractor shall clamp flashing ring to roofing as coordinated with Roofing
Contractor.

Plumbing Fixtures
Roughing-In Dimensions - Install the fixtures to the roughing-in dimensions shown on the architectural
plans.

Water Closets
Mounting: Closet bowl to be solidly fastened to closet carrier or floor flange by brass bolts with stainless
steel caps. Closet bowl to have solid bearing on wall or floor. The closet bowl shall be thoroughly checked
for level and for secure and substantial connection to the closet carrier or floor flange.
Seal: Seal between closet bowl and closet carrier or floor flange to be made with molded wax ring gasket to
ensure absolute gas and watertight seal.
Water Connection: The water connection shall be made to the water closet with trim as specified. All
exposed brass shall be chrome plated, and pipes to wall or floors shall be covered with chrome plated
escutcheon plates and cover tube to fit pipe.

Lavatories
Waste Connection - Waste connection to be made with heavy chromium plated swing joint “P” traps. The
“P” trap shall have standard iron pipe threads for connection to the building drainage system and slip joint
with preformed neoprene or plastic gasket for connection to P.O. plug in lavatory.
Escutcheon plates and cover tube of the proper size shall be installed between trap and wall.
Water Connection - The water connection shall be made to the lavatory with trim as specified. Rough-in all
supply pipe stubs so that supply pipes to lavatory will run in a straight, vertical line from stops to faucets.
All exposed pipe to walls or floors shall be chromium plated and have escutcheon plates.

Mop Basin
Mounting: The mop basin shall be set dead level and have solid bearing on the floor. A mixture of sand and
cement shall be used to level basin and obtain solid bearing.
Waste Connection: The waste connection shall be made with a packed oakum gasket and molten pig lead.
The joint is to be run full at one pouring and caulked flush with the top of the drain pipe. A strainer shall be
installed in the basin drain after the joint is made.
Water Connection: The water connection shall be made with trim as specified. Hose end threads shall have
a spout outlet vacuum breaker.

General
All fixtures shall be set in a true and level manner with connection to soil, waste, vent, and water supply
pipes. Adjust all valves, pack all stuffing boxes and leave work in a finished, clean and satisfactory
working condition.
Protect all fixtures after they are set. This Division of the Work is responsible for them until the acceptance
of the work, at which time all fixtures shall be in perfect condition and complete working order. Strictly
advise all other Divisions to refrain from using toilets, especially before water connections have been made.
All bolting and fastening to walls, etc., must be with through type toggles and washer bolting. No screw and plug or expansion shield fastenings will be accepted. All fixture fastenings shall be made with steel bar supports and plates or other approved method.

At all wall hung lavatories and electric water coolers, Contractor must install thru going bolts in hole provided in bottom rear drapery to prevent lifting of front rim.

Seal all openings between floors, walls and fixtures with a mildew-resistant silicone sealant. Sealant shall be white for white fixtures and clear for colored fixtures.

Wall mounted fixtures shall be rigidly supported by a concealed hanger which is attached to structural members so that the load is not transmitted to the fixture drain connection or any other part of the plumbing system.

All countertop stainless steel sinks shall be set in a silicone caulk.

Barrier Free Requirements
All barrier free requirements shall comply with ICC/ANSI A117.1 requirements and Wisconsin Building Code requirements.

Water Closets: The height of barrier free water closets shall be 17” to 19” to the top of the toilet seat from finished floor. Flush controls shall be hand operated or automatic and shall be mounted on the wide side of the toilet area no more than 30” above the floor.

Urinals: Urinals shall be the stall type or if wall hung shall have an elongated rim no more than 17” above the finished floor. Flush controls shall be hand operated or automatic.

Lavatories: Lavatories shall be mounted with the rim or counter surface no higher than 34” above finished floor and shall have a 29” clearance between finished floor and the bottom of the apron. Hot water and drain pipes under lavatories shall be insulated or otherwise configured to protect against contact and there shall be no sharp or abrasive surfaces under lavatories. Faucets shall have lever-operated, push type or sensor type controls and shall remain open at least 10 seconds.

Electric Water Coolers: Electric water cooler spouts shall be no higher than 36” above finished floor. Wall and post mounted cantilevered units shall have a clearance of 27” from the bottom of the apron to finished floor. Self-contained units shall have a clear floor space at least 30” x 48” for a parallel wheelchair approach. Controls shall be front mounted or side mounted near the front edge.

Bathtub and Showers: Bathtubs and showers shall have a shower spray unit with an ADA compliant hose that can be used both as a fixed shower head and as a hand held shower. Shower valve shall be installed between 38” and 48” above finished floor and offset 8” from shower head in the direction of shower entrance.

Sinks: Sinks shall be mounted with the counter or rim no higher than 34”, a maximum sink depth of 6½”. Faucet shall have lever-operated, push type, touch type, or sensor type controls. Hot water and drain pipes exposed under sinks shall be insulated or otherwise configured so as to protect against contact and there shall be no sharp or abrasive surfaces under the sink.

OWNER TRAINING
Provide minimum of one hour training on equipment operation.

* * * * *
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 GENERAL
A. Hereinafter, the term “Mechanical Contractor” shall be intended and interpreted as defining the term “Heating, Ventilating and/or Air Conditioning Contractor”.
B. Hereinafter, the terms “Mechanical System” and “Mechanical Equipment” shall be intended and interpreted as defining the terms “Heating, Ventilating and/or Air Conditioning System or Equipment”.
C. If the bidding documents contain conflicting information or discrepancies, the bidder shall base his bid upon the conflict or discrepancy which will result in the highest first cost.
D. The drawings are schematic in nature. All required ductwork and piping offsets, transitions, fittings, and supports shall be included in the base bid to accommodate actual field conditions. Final locations of all work shall be coordinated in the field and installed where directed by the Owner’s Representative.

1.3 REFERENCE STANDARDS
A. Abbreviations of standards organizations referenced in other sections are as follows:
   1. AABC - Associated Air Balance Council
   2. ABMA - American Boiler Manufacturers Assoc.
   3. ADC - Air Diffusion Council
   4. AGA - American Gas Assoc.
   5. AMCA - Air Movement & Control Assoc.
   6. ANSI - American National Standards Institute
   7. ARI - Air Conditioning & Refrigeration Institute
   8. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
   9. ASME - American Society of Mechanical Engineers
   10. ASTM - American Society of Testing and Materials
   11. AWWA - American Water Works Assoc.
   12. AWS - American Welding Society
   13. CGA - Compressed Gas Assoc.
   14. CTI - Cooling Tower Institute
   15. EPA - Environmental Protection Agency
   16. GAMA - Gas Appliance Manufacturers Assoc.
   17. IEEE - Institute of Electrical & Electronics Engineers
   18. ISA - Instrument Society of America
   19. MCA - Mechanical Contractors Assoc.
1.4 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Section GC - General Conditions of the Contract.

B. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

1.5 CONTINUITY OF EXISTING SERVICES

A. Refer also to Section GR - General Requirements.

B. Do not interrupt or change existing services without prior written approval from the Owner. When interruption is required, coordinate the down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

1.6 PROTECTION OF FINISHED SURFACES

A. Refer also to Section GR - General Requirements

B. Furnish one can of touch-up paint for each different color factory finish which is to be the final finished surface of the product. Deliver touch-up paint with other “loose and detachable parts” as covered in the General Requirements.

1.7 CODES, PERMITS, TAXES AND CERTIFICATES OF INSPECTION AND APPROVAL

A. This system shall be installed in accordance with all national, state and local codes and regulations.

B. Mechanical equipment shall comply with the requirements of ASHRAE 90-1.

C. The Mechanical Contractor shall secure and pay for all permits, licenses and certificates of inspection applicable to this work.

D. The Mechanical Contractor shall pay for all taxes applicable to this work.

E. Copies of the certificates shall be included in the Operating and Maintenance Instructions.

1.8 SHOP DRAWINGS

A. The Mechanical Contractor will be held responsible for correction of work deemed necessary by the Engineer due to proceeding with the work without certified drawings that have the Engineer’s final approval.
B. Certified drawings shall include data on physical dimensions, gauges, materials of construction and capacities as follows:

1. All HVAC equipment.
2. Ductwork, flexible ductwork, and acoustical duct lining.
3. Piping systems.
4. Piping and water/steam specialties.
5. HVAC insulation.
6. Refrigerant specialties.
7. Temperature control system.
8. Testing and balancing reports.

C. Incomplete certified drawings will be disapproved.

D. Manufacturers shall check the plans and verify that their equipment can be installed in the space allotted and still have adequate room for servicing.

E. Approval of certified drawings describing equipment that cannot fit in the space allotted does not relieve the Mechanical Contractor from furnishing and installing equipment that will meet the space requirements.

F. Approval of certified drawings not fully describing or specifically stating all components of a major item or system shall not be construed to indicate that these items may be omitted or are not required. All components necessary to comply with the requirements of the system or the intent of the plans and specifications and all governing codes and regulations must be furnished and installed.

G. Approval of certified drawings covering equipment that does not meet the requirements of the plans and/or specifications does not relieve the Mechanical Contractor from furnishing and installing the equipment required.

H. Submit to Engineer for approval an electronic copy of manufacturer’s certified drawings in PDF format for all equipment. Drawings for the automatic controls shall include sequence description.

1.9 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Refer also to Section GR - General Requirements.

B. Submit to Engineer for approval, an electronic copy of the complete operating and maintenance manual in PDF format.

C. Prepare and deliver to the Owner three hard copies of operating manuals along with the electronic PDF file.

D. Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:

1. Copies of all approved shop drawings.
2. Manufacturer’s wiring diagrams for electrically powered equipment.
3. Records of tests performed to certify compliance with system requirements.
4. Certificates of inspection by regulatory agencies.
5. Temperature control record drawings and control sequences.
6. Parts lists for manufactured equipment.
7. Valve schedules.
8. Lubrication instructions, including list/frequency of lubrication done during construction.
10. As-built drawings.

1.10 VISITING OF JOB SITE
A. The Mechanical Contractor is required to visit the premises and take note of all existing conditions which may affect his work; and he shall be responsible for knowledge of same in the preparation of his bid.
B. Lack of information on existing conditions shall not be allowed as a valid cause for additional compensation.

1.11 ASBESTOS NOTIFICATION
A. Portions of the existing equipment and piping within the project scope may contain asbestos bearing materials. If, during the construction of this project, work involving friable asbestos is suspected or encountered, the Owner or the Owner’s representative shall be notified immediately and the Owner, with his own forces or by separate contract, shall be responsible for complete investigation, removal and disposition of the friable asbestos hazard in accordance with applicable laws and regulations.

1.12 FINAL REQUIREMENTS
A. Materials, fittings, apparatus, fixtures, etc., not particularly specified or shown on plans but necessary to provide a first class mechanical system for the building, must be furnished notwithstanding such omission.
B. Oil from mechanical system must not be allowed to enter the boilers; the water must be drained by the Mechanical Contractor until all parts are free from oil, dirt or other foreign matter before returning to the boiler.
C. At the completion of the work, the entire plant must be delivered to the Owner in perfect working order with all joints tight, valves packed and adjusted.
D. All equipment utilizing air filtering equipment shall have all throwaway filters replaced with new filters and all permanent filter media thoroughly cleaned prior to presenting the system to the Owner for acceptance.
E. At project closeout, provide to the Owner two (2) extra sets of filters for all equipment utilizing air filtering equipment installed as part of this project.
F. All air handling equipment shall be thoroughly cleaned on both the inside and outside of the unit casing prior to presenting the system to the Owner for acceptance.
G. Balance the entire air system to deliver and exhaust air quantities as designated, with allowable error of plus or minus 5%. Submit to the Engineer in triplicate, complete air and water balancing data sheets as hereinbefore specified.
H. All tests and trials of the entire system requested or directed by the Engineer must be made by the Mechanical Contractor free of charge before acceptance of the work.
I. Upon completion of the installation, but before final acceptance of the system, the Mechanical Contractor shall instruct the Owner on the care and operation of all parts of the system.
1.13 GUARANTEE

A. This Contractor guarantees all work, new material and apparatus to operate to the satisfaction of the Engineer for one year from the completion and acceptance of the system and must keep same in repair for said period, unless such defects are clearly the result of bad management after apparatus is out of his control.

B. The guarantee period shall start when the system has been accepted by the Engineer as being in working order.

C. Equipment warranties shall be effective from the date of substantial completion and acceptance. This Contractor shall provide factory start-up services for all equipment when available from the equipment manufacturer.

D. This Contractor guarantees the system to properly circulate hot water to all parts of the system.

E. The ventilating system shall be guaranteed to deliver and exhaust amounts of air as noted on plan to within plus or minus 5%.

F. The temperature control system shall be guaranteed to maintain the temperatures at the instruments to within plus or minus one degree of their setting.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 DEMOLITION

A. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe or duct is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

B. All pipe, wiring and associated conduit, insulation, ductwork, and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor. All piping and ductwork specialties are to be removed from the site by the Contractor unless they are dismantled and removed or stored by the Owner. All designated equipment is to be turned over to the Owner for his use at a place and time he so designates. Equipment not retained by the Owner shall be removed from the premises.

3.2 EQUIPMENT SUPPORTS

A. General:

1. Furnish and install all equipment supports as indicated or required for the installation of all mechanical equipment, including miscellaneous upper steel as required to frame into overhead construction for distribution of weight.

2. All equipment supports shall incorporate anti-vibration isolation, hanger assemblies, concrete inserts, etc., as required.

3. Concrete anchors shall be installed in predrilled holes. “Shot-in” anchors will not be acceptable.

4. All concrete anchor inserts shall be metallic. Non-metallic inserts will not be acceptable.

5. Concrete inserts shall be furnished and located by the Mechanical Contractor and set by the Contractor responsible for pouring the concrete.
6. Wood screws or toggle bolts shall be used for mounting equipment in frame construction.

7. Mechanical equipment shall not support or be supported by any active piping or ductwork.

B. Steel Supports:

1. Steel supports in the form of pipe stands, rails, suspension frames, brackets, braces, etc., shall be furnished and installed for mechanical equipment indicated and/or required to have steel supports.

2. Shall be constructed to properly support and distribute the load.

3. Shall incorporate anti-vibration devices, anti-sway bracing, saddles and anchoring plates as required.

4. May be constructed of steel pipe, I-beams, channels, angle iron, or threaded steel rods.

5. All permanent supports shall be welded.

6. Support members which must be moved may be bolted or threaded pipe.

7. All threaded rods and bolts shall have nuts welded to rods, threads peened, or double nuts.

C. Roof Curb Mounted Equipment:

1. Roof curbs shall be sized to accommodate the roof openings and curb flange of the equipment being mounted.

2. Roof curbs shall be constructed suitable to accommodate anchoring of the equipment being mounted with a minimum of 12” clearance from top of the roofing material to top of roof curb.

3. See Architectural plans for roof deck, type, pitch and insulation thickness.

4. Flashing and roof sealing of curbs including sealing of flashing flanges, cant strips, pitch seals at anchor bolts, etc., shall be by the Roofing Contractor.

5. Roof curbs shall be furnished and set in place by the Mechanical Contractor.

D. Support Blocks:

1. Support blocks for small equipment, piping, and/or ductwork shall be rubber support blocks with top channel where specifically indicated. Channel shall be secured to the tray with through bolts.

2. Dura-Blok or equal.

E. Finished Area Mechanical Equipment:

1. Wall and Floor Units:
   a. Shall be set plumb and true.
   b. Shall include all necessary flanges, trim strips, end closures, etc.
   c. Shall be securely anchored in place.
   d. Setting and anchoring shall be in accordance with manufacturers details and recommendations.

2. Finished Ceiling Mounted Units:
   a. Shall have concealed steel supports as hereinbefore specified.
b. Flush and/or recessed equipment shall be supported from threaded hanger rods which can be drawn up to bring cabinet flush and/or tight to ceiling.

c. Recessed units shall be installed with recessing flanges furnished with the unit.

3.3 SLEEVES, OPENINGS, CUTTING AND PATCHING (NEW CONSTRUCTION)

A. Provisions for openings (except pipe sleeves) but including chases, holes and clearance through walls, floors, roof, ceilings and partitions shall be made in advance of construction of such parts of the building. These openings will be provided by Others during the construction of the building, but it shall be the responsibility of the Mechanical Contractor to furnish the applicable contractor with all opening dimensions where required for installing the mechanical work. These dimensions shall size and locate the openings.

B. If the Mechanical Contractor should neglect to inform the other Contractors of his opening requirements before that portion of the building construction has been completed, the Mechanical Contractor shall cut his own openings and provide framings and lintels as required. Before cutting or drilling, he must obtain permission from the Engineer and he shall repair any damage to his satisfaction. In event holes must be cut through reinforced concrete, drill carefully so as to avoid spalling and unnecessary damage or weakening of structural members. No chopping or breaking out permitted.

C. Precedence in installing equipment and piping in close quarters will be as determined by the Engineer but no contractor has exclusive right-of-way in installing his work.

D. Confer and cooperate with other Contractors and agree as to running of pipe lines and ducts subject to Engineer’s approval.

E. Pipe Sleeves:

1. The Mechanical Contractor shall furnish and install in place, pipe sleeves which shall be ½” larger in diameter than insulation on insulated pipe lines or ½” larger in diameter than the outside pipe diameter on uninsulated piping. The sleeves shall be of sufficient length to pass through the entire floor or wall construction. (In addition, where sleeves pass through equipment room floors, the top of the sleeves shall terminate at a minimum of 2” above the finished floor line.)

2. Where piping passes through floors, walls or decks of frame construction, sleeves shall be constructed of 22 gauge galvanized formed sheet steel. Piping passing through floors, walls or decks of masonry construction, shall have sleeves constructed of Schedule 40 wrought iron or steel pipe.

3. The Mechanical Contractor shall be responsible for the locating of all pipe sleeves.

4. Note:

a. Sleeves are not required for holes drilled in masonry or concrete construction except in equipment room floors.

b. The Mechanical Contractor shall be responsible for the water tightness of all openings through the roof, outside walls and equipment room floors required for the mechanical system.

F. Duct Sleeves:

1. The Mechanical Contractor shall furnish and install in place in equipment room floors duct sleeves which shall be ½” larger in each dimension than insulation on insulated ducts or ½” larger in each dimension than the outside of the duct on
uninsulated ducts. The sleeves shall be of sufficient length to pass through the entire floor construction. The top of the sleeves shall terminate at a minimum of 2" above the finished floor line. Sleeves shall be set in place before final floor topping is poured.

2. Sleeves shall be constructed of 16 gauge galvanized formed sheet steel.

3. The Mechanical Contractor shall be responsible for the locating of all duct sleeves.

3.4 DUCT TRIM STRIPS

A. The Mechanical Contractor shall furnish and install finish trim strips of 20 gauge galvanized formed sheet steel or angle iron for all exposed ductwork wall penetrations.

3.5 CUTTING AND PATCHING (EXISTING CONSTRUCTION)

A. The Mechanical Contractor shall do all cutting and patching required to install all piping, ductwork, equipment, etc., for the mechanical system.

B. The Mechanical Contractor shall do all patching required as a result of demolition work associated with the installation of the mechanical systems unless indicated otherwise.

C. All holes cut through reinforced concrete must be drilled carefully so as to avoid spalling and unnecessary damage or weakening of structural members. No chopping or breaking out permitted.

D. Furnish and install 22 gauge galvanized pipe sleeves for all piping except piping passing through drilled holes. Sleeves to be ½" larger in diameter than the insulation diameter, and of length to pass through the entire floor or wall construction.

E. Furnish and install lintels in all wall openings.

F. Furnish and install additional steel as required to frame all ductwork openings in floors and roofs. Provide watertight roof curbs for all roof mounted equipment.

G. Provide all cutting and patching required to move new mechanical equipment into the building.

H. All patching shall be done to restore the construction to its original conditions and acceptable in appearance to the Owner and Engineer.

I. Provide a weathertight seal on all openings through exterior walls and roof.

J. Provide a watertight seal on all openings through floors in and above finished areas.

3.6 GENERAL

A. Equipment Access:

1. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with other trades, making sure that access is available for all equipment and specialties.

B. Coordination

1. Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, diffusers, register, grilles, and recessed or semi-recessed heating and/or cooling terminal units installed in/on architectural surfaces.

2. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.
3. The Mechanical Contractor shall coordinate the installation of the gas meter and confirm gas pressure with the utility responsible for gas service to the building.

C. Lubrication

1. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by the Owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

End Section 23 05 00
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 RELATED WORK
   A. 23 07 00 HVAC Insulation

1.3 QUALITY ASSURANCE
   A. Substitution of Materials: Refer to General Conditions of the Contract.

1.4 SHOP DRAWINGS
   A. Include dimensions, capacities, materials of construction, weights, wiring diagrams and appropriate identification for all equipment in this Section.

1.5 DESIGN CRITERIA
   A. Constructed in accordance with ASME.

PART 2 - PRODUCTS

2.1 GENERAL
   A. Mechanical Contractor shall furnish all concrete inserts, expansion shields, hanger rods, beam clamps, etc., as required for support of all piping installed by him.
   B. Beam clamps shall be forged steel concentric loaded type with tie rod to lock clamp in place for all piping 5” through 8”. C type clamps may be used for piping smaller than 5”.
   C. Pipe support brackets and trapeze type hangers for piping shall be fabricated by the Mechanical Contractor.
   D. All threaded support rod and bolts shall have either nuts welded to rods, threads peened or otherwise upset, or a double set of nuts to prevent unthreading of nuts.
   E. All hanging equipment shall be suitable for piping supported.

2.2 PIPE HANGERS
   A. Manufacturers: B-Line, Fee and Mason, Anvil International, Unistrut or approved equal. Grinnell figure numbers are listed below; equivalent material by other manufacturers is acceptable.
   B. Furnish Grinnell Fig. 260 clevis type pipe hangers for all piping unless otherwise indicated.
   C. Furnish Grinnell copper plated Fig CT-65 light duty adjustable wrought clevis copper tubing hangers for uninsulated copper tubing.
   D. Furnish Grinnell Fig. 261 riser clamps to support vertical piping where required.
   E. Furnish Grinnell pipe covering protection saddles at all hanger locations on insulated hot piping 1-1/2” and larger.
   F. Furnish Grinnell Fig. 167 protection shields at all hanger locations on insulated piping smaller than 1-1/2”.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Support all piping neatly and in an approved manner to allow for expansion, contraction and vibration. Piping shall be supported not more than 10 ft. between hangers and closer where required to prevent sagging or where required by local code, ordinance or the International Fuel Gas Code.

B. On hot piping, smaller than 1-1/2", the hanger may be secured directly to the pipe and the pipe insulation surround the hanger. On hot piping, 1-1/2" and larger, the covering protection saddles specified above shall rest on the pipe insulation.

C. Piping shall be anchored where indicated or required. Submit anchor drawings to the Architect for approval when directed.

End Section 23 05 12
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 RELATED WORK
   A. 26 00 00 Electrical for Power Wiring

1.3 QUALITY ASSURANCE
   A. Substitution of Materials: Refer to General Conditions of the Contract.

1.4 SHOP DRAWINGS
   A. Include dimensions, capacities, materials of construction, weights, wiring diagrams and
      appropriate identification for all equipment in this Section.

1.5 REFERENCE STANDARDS
   A. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators
   B. Constructed in accordance with ASME
   C. ANSI/NEMA MG-1 - Motors and Generators
   D. ANSI/NFPA 70 - National Electrical Code

PART 2 - PRODUCTS

2.1 MOTOR REQUIREMENTS
   A. All electric motors shall be NEMA standard motors rated as indicated on the motor starter
      schedule.
   B. All motors 1 HP and larger shall meet or exceed requirements of ASHRAE 90.1.
   C. All motors 1-1/2 HP and larger shall meet or exceed local utility requirements for high
      efficiency motors. Mechanical Contractor shall verify current requirements with utility.

2.2 STARTING EQUIPMENT
   A. Manufacturers: Allen-Bradley, Cutler Hammer, Eaton, Square D, General Electric,
      Franklin Control Systems, Taco, or ABB Control Inc.
   B. All starters shall be NEMA standard sizes and all starting equipment shall be of the same
      manufacturer.
   C. All starters, pushbuttons and selector switches shall have NEMA Type 1 enclosures.

2.3 STARTERS
   A. All manual starters shall be two pole for single phase fractional horsepower service with
      lockable on-off switch, hand-off-auto, power-run-fault indication lights, electronic overload
      protection, control system contacts, auxiliary dry contacts, manual-auto reset selection,
      fault relay, status relay, and power failure return mode.
   B. All starters shall be equipped with auxiliary contacts or control relays for equipment
      control interlocking as required.
PART 3 - EXECUTION

3.1 MECHANICAL CONTRACTOR

A. Shall furnish all starting equipment including selector switches, relays, etc. He shall turn all manual and magnetic starters over to the Electrical Contractor with complete instructions and wiring diagrams required for a complete installation. All other control equipment shall be turned over to the Temperature Control subcontractor for installation.

B. Shall furnish and install all control wiring.

C. Shall confirm voltage requirements with the Electrical Contractor prior to ordering equipment.

3.2 ELECTRICAL CONTRACTOR

A. Will furnish and install all fused and/or circuit breaker disconnect switches, except as indicated otherwise.

B. Will furnish and install all power wiring from panel board to motors and junction boxes in factory-assembled units.

C. Will install all starters in cooperation with and under the supervision of the Mechanical Contractor.

End Section 23 05 13
23 05 15 VIBRATION ISOLATORS

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 RELATED WORK
   A. 23 74 10 Rooftop Air Conditioning Units
   B. 23 34 00 Fans

1.3 QUALITY ASSURANCE
   A. Substitution of Materials: Refer to General Conditions of the Contract.

1.4 SHOP DRAWINGS
   A. Include dimensions, capacities, materials of construction, weights, wiring diagrams and appropriate identification for all equipment in this Section.

PART 2 - PRODUCTS

2.1 GENERAL
   A. All mechanical equipment shall be mounted on vibration isolators, unless otherwise indicated on the schedules, to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the equipment weight distribution so as to produce uniform deflection and deflections shall be as noted on the equipment schedules. Isolators shall be furnished by the mechanical equipment manufacturers.

2.2 VIBRATION ISOLATORS
   B. Hanger types as follows:
      1. Type D: Shall contain a spring and double deflection neoprene element in series. Neoprene elements shall have a minimum deflection of 0.3" and spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Minimum additional travel to solid equal to 50% of the rated deflection.
   C. Roof Curbs:
      1. Type SP: Insulated steel base frame with inner supports for field installation of gypsum board sound barrier. Upper steel frame for continuous support of equipment being mounted. Adjustable and removable steel springs on ¼" neoprene acoustical pads with minimum deflection as indicated. Weatherproofing to be continuous flexible aluminum seal joined by EPDM bellows. All hardware must be stainless or galvanized steel.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Install all isolators for all equipment as indicated on the drawings as in accordance with manufacturers recommendations.
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 RELATED WORK
A. 23 74 10 Packaged Rooftop Units

1.3 QUALITY ASSURANCE
A. Substitution of Materials: Refer to General Conditions of the Contract.

1.4 SHOP DRAWINGS
A. Include dimensions, capacities, materials of construction, weights, wiring diagrams and appropriate identification for all equipment in this Section.

PART 2 - PRODUCTS

2.1 V-BELT DRIVES
A. Manufacturers: Browning or Woods.
B. Furnish for 7-1/2 HP and Smaller Motors:
   1. Woods Type FHP or Browning Type LVP cast iron sheaves of size and number grooves required. Complete with adjustable flanges and locking devices.
C. For all drives belt speed shall not exceed 5000 fpm, all sheaves shall be dynamically balanced, all sheaves shall be selected with a 1.5 minimum service factor and the center distances, arc of contact, ratio and belt type shall be as recommended by drive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION
A. All sheaves shall be mounted on motors and fans and properly aligned in accordance with manufacturers instruction and belt installed with the tension as recommended.

End Section 23 05 16
23 05 93 TESTING 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 work of this Section.

1.2 RELATED WORK
A. 23 09 00 Building Automation System for HVAC

PART 2 - PRODUCTS       NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS
A. The Mechanical Contractor shall obtain the services of an NEBB or AABC certified independent subcontractor who specializes in and whose business is limited to testing, adjusting and balancing of air and water distribution systems. All tests shall be performed with recently calibrated instruments suitable for the test being performed. This subcontractor shall be responsible for complete testing, adjusting and balancing of the hydronic systems and all new and remodeled air moving systems.

B. Inspecting, Checking and Testing System:
   1. Mechanical Contractor shall submit to the owner, in triplicate, at the completion of his work a certified statement signed by a principal of the firm stating that the system has been fully adjusted and balanced in accordance with requirements outlined and that all system components have been checked and tested, adjusted, and is operating properly as noted by plans and specifications. This statement shall be submitted before the system is presented to the Owner for final inspection.

3.2 HYDRONIC BALANCE
A. The balancing work shall include the compiling of data, submitting reports and performing the following tests:
   1. Pumps
      a. Design Data:
         1) GPM.
         2) RPM, BHP.
      b. Installed Equipment:
         1) Manufacturer, size.
         2) Impeller diameter as shipped.
         3) Impeller diameter after trimming for installed conditions.
         4) Type drive.
         5) Motor HP, volts, cycles and phase.
         6) Full load amperes.
      c. Field Test:
         1) Discharge pressures: Full flow and no flow.
         2) Suction pressures: Full flow and no flow.
3) Operating head and GPM.
4) Full flow amperes, no flow amperes.
5) Calculated BHP.

d. Primary water balancing shall be accomplished by trimming of the pump impeller. Fine balancing only will be permitted by means of triple duty and/or balancing valves.

2. Heating and Cooling Elements:
   a. Design Data:
      1) MBH specified, GPM specified.
      2) GPM actual.
      3) Element type specified.
   b. Field Test:
      1) Identify each element as to location.
      2) Required water temperature drop.
      3) Actual entering air and water conditions (temperature and GPM).
      4) Adjust element until required temperature drop is obtained.

B. In addition to the above work, the contractor shall check operation of all automatic temperature control equipment; verify all setpoints and operations; and enlist the aid of the control contractor to make necessary adjustments where required.

3.3 AIR BALANCE WORK
A. The balancing work shall include, but not be limited to the following items:
1. The setting and adjusting of all dampers, deflecting vanes, discharge vanes and accessories to achieve indicated air distribution patterns in all parts of the air systems. Air quantities shall be as designated, with allowable error of plus or minus 5%.
2. The setting and adjusting of all belted fan speeds as may be required to attain proper total CFM deliveries, including the furnishing and installation of additional belts and drives as dictated by field conditions.
3. The inspection of the function and operation of all automatic controls to ensure proper operation and control cycles.
4. Submitting a report on each phase of the work.
5. Air balancing shall be accomplished with duct volume dampers and not dampers at the terminal outlets. Fine balancing will be permitted by means of terminal outlet dampers.
6. Record all test data in triplicate and submit to Architect.
7. Air System Balance:
   a. With the air handling systems set to operate on minimum fresh air the Balancing Contractor shall perform the following tests and compile the following information:
      1) Air Handling Equipment
         a) Design Conditions:
i) CFM supply air.
ii) Static pressure.
iii) Motor HP
iv) CFM fresh air.
v) Fan RPM.
vi) Fan motor brake horsepower.

b) Installed Equipment:
i) Manufacturer.
ii) Size.
iii) Arrangement, discharge class.
iv) Motor HP, voltage, phase, cycles, full load amperes.

c) Field Test:
i) Fan speed.
ii) No load operating amperes.
iii) Fan motor operating amperes.
iv) Calculated BHP.

d) Test for Total Air:
i) Size of discharge and outside air ducts.
ii) Number of and location of velocity and pressure readings.
iii) Duct average velocity.
iv) Total CFM.

2) Individual Terminal Outlets:
   a) Identify each supply outlet and exhaust as to location area and fan system.
   b) Manufacturer and type.
   c) Size.
   d) Free area, core area or neck area.
   e) Terminal factor.
   f) Required FPM and test velocity.
   g) Required CFM and test results.

b. In addition to the above work, check operation of all automatic temperature control equipment; verify all thermostat, aquastat, airstat, etc., setpoints and operations; and enlist the aid of the control subcontractor to make necessary adjustments where required.

End Section 23 05 93
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 RELATED WORK
A. Duct Lining Section 23 31 00 Sheet Metal Work

1.3 QUALITY ASSURANCE
A. Substitution of Materials: Refer to General Conditions of the Contract.

1.4 SHOP DRAWINGS
A. Submit a schedule of all insulating materials to be used including adhesives, fastening methods, fitting material and intended use of each material. Include manufacturer’s data sheets indicating density, thermal characteristics, jacket type and manufacturer’s installation instructions.

1.5 DEFINITIONS
A. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk through tunnels shall be considered as exposed.

PART 2 - PRODUCTS

2.1 GENERAL
A. All insulation, facings, mastics and tapes installed within the building shall have a composite flame and smoke hazard rating as tested by procedure ASTM E-84-80, NFPA-255 and UL-723, not exceeding 25 flame spread or 50 smoke developed.

B. All insulation, facings, mastics, sealants and tapes shall be free of asbestos.

C. Duct insulation to be applied after duct tape and adhesive and/or duct sealant is applied by sheet metal contractor. Allow sufficient time for tape and adhesive to dry and/or duct sealant to cure before insulating ducts.

D. Repair all existing pipe and duct insulation damaged by installation of this system.

2.2 HOT PIPING
A. Type of piping and thickness:
   1. Hot water supply and return piping (200 deg. F or less).
      a. One and one-half inch (1-1/2") thickness on piping 1-1/2" and less.

B. Owens-Corning Fiberglass ASJ/SSL-II, Manville, Certainteed or Knauf fiberglass pipe insulation molded to conform to the pipe and split for application.

C. Minimum R=4 per inch thickness.

D. Complete with flame retardant kraft reinforced foil all service white jacket. Jacket shall have a factory applied double pressure sensitive adhesive to adhesive closure flap. Circumferential end joints shall be sealed with self-sealing 3" wide kraft reinforced foil white butt strips.

E. All valve bodies, flanges, clamp type pipe couplings and fittings shall be wrapped with fiberglass blanket, or segments of pipe insulation securely tied in place to a thickness slightly greater than the adjoining insulation. Wrap Manville “Zerotape” over the
insulation and finish with an open weave glass cloth imbedded in two coats of Benjamin Foster No. 30-36 or Childers CP-50 fire resistive white sealer.

F. Premolded one piece 25/50 rated PVC insulated fitting covers may be used in lieu of insulating cement and glass cloth at valve bodies, flanges, clamp type couplings and fittings. Factory pre-cut fiberglass insulation shall be applied to the fitting with the insulation tucked into the throat of the fitting and the edges of the adjacent pipe covering. The PVC cover shall be applied and secured by stapling and applying pressure sensitive tape over the staples and at the circumferential edges.

G. Vertical soft copper tubing concealed in building construction shall be covered with Armaflex AP, Aeroflex or Rubatex flexible, plenum rated, antimicrobial, closed cell elastomeric foam pipe insulation. All joints and seams are to be sealed with Armaflex 520 BLV low VOC adhesive or equal.

2.3 PIPING EXPOSED WITHIN OCCUPIED SPACES

A. Cover pipe insulation installed exposed within occupied spaces with white semi-gloss 0.03” (30 mil) thick PVC covers and jackets. End to end joints must be lapped a minimum of 2” and be sealed with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4” without fasteners where required to absorb expansion and contraction.

2.4 REFRIGERANT SUCTION PIPING INSTALLED OUTSIDE OF THE BUILDING

A. Cover piping installed outside of the building with Armaflex, or Rubatex flexible black closed cell elastomeric foam pipe insulation. Join all edges with Armaflex No. 520 or Rubatex No. 373 adhesive. Paint insulation with 2 coats of Armaflex WB white water base type coating or Rubatex 374 white water base coating in accordance with manufacturers recommendations.

2.5 DUCTWORK

A. Type of ductwork and type of insulation:
   1. All exhaust air ductwork from automatic exhaust air damper to roof or wall termination except acoustically lined ductwork. Rigid Board
   2. All supply air ductwork except ductwork exposed within an air conditioned space and acoustically lined ductwork. Duct Wrap

B. Rigid Board insulation:
   1. Minimum two and one half inch (2.5”) thick Owens-Corning, Manville, Certainteed or Knauf fiberglass duct insulation with factory applied aluminum foil reinforced kraft vaporproof facing.
   2. Exposed duct flanges shall be covered with 3” wide strips of rigid duct insulation with a factory applied aluminum foil reinforced kraft vaporproof facing. The jacket shall extend beyond both sides of the insulation strip by a minimum of 2” to provide a pasting flap. These flaps shall be pasted and sealed with Benjamin Foster 85-20 adhesive.
   3. The insulation shall be fastened to the duct with fire resistive adhesive (100% coverage) and Graham welding pins located on a maximum of 18” centers and not less than 3” from each edge or corner of the board. Stick-Klip fasteners may be used in lieu of welding pins providing they are installed in accordance with the manufacturers recommendations on a clean surface with Type S adhesive.
   4. Completely cover all insulated ductwork with a heavy coat of Benjamin-Foster 30-36 Sealfas or Childers CP-50. Imbed an open weave glass cloth and while
still wet apply a finish coat of Benjamin-Foster 30-36 or Childers CP-50 fire resistive white sealer.

5. Concealed Ductwork: Same as above except glass cloth and 2 coats of Benjamin Foster 30-36 or Childers CP-50 not required.

6. The entire assembly shall provide a minimum R=6 for all indoor ductwork.

7. The entire assembly shall provide a minimum R=10 for all outdoor ductwork.

C. Duct Wrap Insulation:

1. Minimum two and one half inch (2.5") thick Owens-Corning, Manville, Certainteed or Knauf 0.75 lbs. per cu. ft. density fiberglass blanket type duct insulation with factory applied reinforced foil vapor barrier facing and a 2” stapling and taping flange.

2. Insulation shall be installed with facing outside so that tape flaps overlap at opposite end. Insulation shall be tightly butted. Seams shall be stapled 6” on center. Seal joints with pressure sensitive tape matching the facing.

3. Where rectangular ducts are greater than 24” in width insulation shall be secured to the bottom of the duct with mechanical fasteners spaced on 18” centers to prevent sagging of insulation.

4. Seal all tears, punctures and other penetrations of facing with tape or mastic to provide a vapor tight system installation.

5. The entire assembly shall provide a minimum R=6.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Systems and/or equipment which is specified to be pressure tested or inspected shall not be insulated until testing and inspection has been successfully completed.

B. Insulation jackets and accessories shall only be installed under ambient temperatures recommended by the manufacturer of the material.

C. Install insulation with smooth and even surfaces and on clean, dry surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Use full length material wherever possible.

End Section 23 07 00
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 RELATED WORK
A. 23 09 93 Control Sequences
B. 23 74 10 Packaged Rooftop Units
C. Division 26 Electrical

1.3 DEFINITIONS
A. BACnet: Building Automation and Control Network Standard (ASHRAE 135)
B. BAS: Building Automation System
C. DDC: Direct digital control.
D. I/O: Input/output.
E. MS/TP: Master slave/token passing.
F. PC: Personal computer.

1.4 SYSTEM DESCRIPTION
A. The Building Automation System (BAS) manufacturer shall furnish and install a fully integrated building automation system, as an extension of the existing BAS, incorporating direct digital control (DDC) for all equipment and systems as herein specified.
B. Provide networking to new DDC equipment using communication standards. System shall be open protocol and unlocked Tridium-based environment capable of BACnet communication according to ASHRAE standard ANSI/ASHRAE 135 for interoperability with smart equipment where indicated and for the main IP communication trunk to the BAS Server.
C. All necessary software (open license), hardware, firmware, operating equipment, devices and system components required for the system shall be provided by the BAS Contractor whether or not specifically itemized, in order to provide a complete system within the intent of this specification.

1.5 SYSTEM PERFORMANCE
A. Comply with the following performance requirements:
   1. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
      a. Water Temperature: Plus or minus 1 deg F.
      b. Water Flow: Plus or minus 5 percent of full scale.
      c. Water Pressure: Plus or minus 2 percent of full scale.
      d. Space Temperature: Plus or minus 1 deg F.
      e. Ducted Air Temperature: Plus or minus 1 deg F.
      f. Outside Air Temperature: Plus or minus 2 deg F.
      g. Dew Point Temperature: Plus or minus 3 deg F.
h. Temperature Differential: Plus or minus 0.25 deg F.

i. Relative Humidity: Plus or minus 2 percent.

j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.

k. Airflow (Terminal): Plus or minus 10 percent of full scale.

l. Air Pressure (Space): Plus or minus 0.01-inch wg.

m. Air Pressure (Ducts): Plus or minus 0.1-inch wg.

n. Carbon Dioxide: Plus or minus 50 ppm.

o. Electrical: Plus or minus 5 percent of reading.

1.6 SUBMITTALS

A. Product Data:

1. Include manufacturer's technical literature for each control device and software. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

2. Where there are options on the accuracy, signals, covers, ranges, etc., indicate on the data sheet which options area being selected.

3. Schedule of dampers including size, leakage, and flow characteristics.

4. Schedule of valves including flow characteristics.

B. Shop Drawings:

1. Detail system assemblies and indicate device locations, wiring connections, associated control panel connections and sequence of operations to be executed by the DDC program.

2. Bill of materials for all devices, controller, accessories, and software indicating quantity, manufacturer, model number and description. The description shall include options that are chosen for that device, such as accuracy, signals, covers, ranges.

3. Schematic flow diagrams showing fans, pumps, equipment, coils, dampers, valves, and control devices.

4. Written description of sequence of operation.

C. Wiring Diagrams:

1. Power, signal, and control wiring, differentiating clearly between manufacturer-installed and field installed wiring.

D. DDC System Hardware:

1. Wiring diagrams for control units with termination numbers.

2. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.

E. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ANSI/ASHRAE Standard 135 “BACnet – A Data Communication Protocol for Building Automation and Control Networks” where indicated.
F. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors. Revise Shop Drawings to reflect actual installation and operating sequences.

G. Operation and Maintenance Data:
   1. For HVAC instrumentation and control system to include in maintenance manuals. In addition to items specified elsewhere in Division 23 include the following:
      a. Interconnection wiring diagrams with identified and numbered system components and devices.
      b. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

1.7 QUALITY ASSURANCE
A. Provide principal digital temperature control equipment and materials as manufactured by a single manufacturer.
B. All work shall be installed by mechanics, electricians and technicians directly employed by the BAS manufacturer or by an authorized independent manufacturer's field office.
C. The BAS manufacturer shall be responsible for the proper installation and operation of the BAS.
D. Use only UL labeled products which comply with NEMA Standards. Electrical components and installation to meet all requirements of the electrical sections (Division 26) of project specifications.
E. Comply with ANSI/ASHRAE Standard 135 “BACnet – A Data Communication Protocol for Building Automation and Control Networks” where indicated.
F. Store equipment and materials inside and protected from weather.
G. All materials and equipment used shall be standard components, regularly manufactured for HVAC applications. All systems and components shall have been thoroughly tested and proven in actual use.
H. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation or identification number and sequence of operation all bearing the name of the manufacturer. The installing manufacturer shall certify in writing, that the shop drawings have been prepared by the equipment manufacturer and that the equipment manufacturer has supervised their installation. In addition, the equipment manufacturer shall certify, in writing, that the shop drawings were prepared by their company and that all temperature control equipment was installed under their direct supervision.
I. BAS Contractor shall be responsible for all BAS and Temperature Control wiring and conduit for a complete and operable system.
J. BAS Contractor shall provide login information to the Engineer at project completion for a review of the graphical interface and monitoring of the installed system operation. The login shall be for viewing purposes only.

1.8 WIRING
A. All wiring and data cabling shall be done in accordance with all requirements or Division 26 as well as all local and national codes.
B. All electrical wiring required for electrical interlocking, fan timers, selector switches, speed
switches, damper motors, control panels, etc., and all wiring required for the complete
installation of the BAS shall be by the BAS Contractor. The only wiring by the Electrical
Contractor shall be the primary power wiring from panelboards to starters and/or VFD’s
and from starters and/or VFD’s to motors and power wiring to electrical resistance
heating equipment (see E-Series drawings). All other control-related power wiring for the
complete mechanical system shall be by the BAS Contractor.

C. Power wiring for temperature control panels shall be furnished and installed by the BAS
Contractor and shall be connected to separate circuit breakers at the nearest available
panelboards. Coordinate with the Electrical Contractor.

D. Power shall be wired from emergency power equipment branch panels for control panels
serving boilers, pumps, and other equipment on emergency power. Coordinate with the
Electrical Contractor.

E. Data cabling for temperature control devices and/or panels shall be furnished and
installed by the BAS Contractor and shall be connected to building data system routers
and/or switches. Coordinate requirements with the data cabling contractor and the
Owner’s I.T. manager.

1.9 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with
plans and room details before installation.

B. Coordinate equipment with the Electrical Contractor to achieve compatibility with motor
starters and annunciation devices.

1.10 WARRANTY

A. Provide all services, materials and equipment necessary for the successful operation of
the entire BAS system for a period of one year after final acceptance of the system.

B. The adjustment, required testing, and repair of the system includes all computer
equipment, transmission equipment and all sensors and control devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Schneider Electric Struxure installed by Kain Energy as an extension of the existing.

2.2 BAS NETWORK

A. Provide a primary backbone network between the Building Level System Controllers,
BAS Server and Operator Workstations based upon BACnet/IP. Ethernet Network
switches shall be placed throughout the building as required.

B. Building Level System Controllers shall be used for the central plant and air handlers as
indicated and shall reside on the backbone network.

C. The Building Level System Controllers shall be able to support one of several sub-
network protocols that may be needed depending on the type of equipment or
application.

D. Advanced Application Controllers and Application Specific Controllers can reside on the
primary backbone network or on a sub-network.

E. Provide all communication media, data cabling, connectors, repeaters, bridges, switches,
and routers necessary for the internetwork.
2.3 OPERATOR INTERFACES

A. Operator Workstation hardware (OWS):
   1. Personal computer operator workstations shall be provided for command entry, information management, system monitor, alarm management and database management functions. All real-time control functions shall be resident in the Building Controllers to facilitate greater distribution, fault tolerance and reliability of the building automation control.
      a. Furnish and install updated software and hardware as required to bring the existing OWS up to date with the latest versions of all applicable software.

B. Operator Interface Software:
   1. Operator interface software shall minimize operator training through the use of user-friendly and interactive graphical applications, on-line help, and industry standard application software. Interface software shall simultaneously communicate with and share data between connected building level networks.
   2. Provide a graphical user interface that shall minimize the use of keyboard through the use of a mouse or similar pointing device, with a "point and click" approach to menu selection and a “drag and drop” approach to inter-application navigation.
   3. The navigation shall be user friendly by utilizing “forward & back” capability between screens and embedded hyperlinks to open graphics, documents, drawings, etc.
   4. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously.
   5. The software shall provide, as a minimum, the following functionality:
      a. Real-time graphical viewing and control of the BAS environment.
      b. Reporting of both real-time and historical information.
      c. Scheduling and override of building operations.
      d. Collection and analysis of historical data.
      e. Point database editing, storage and downloading of controller databases.
      f. Utility for combining points into logical Point Groups. The Point Groups shall then be manipulated in Graphics, trend graphs and reports in order to streamline the navigation and usability of the system.
      g. Alarm reporting, routing, messaging, and acknowledgment.
      h. Definition and construction of dynamic color graphic displays.
      i. On-screen access to User Documentation, via online help or PDF-format electronic file.
      j. Automatic database backup at the operator interface for database changes initiated at Building Controllers.
      k. Display dynamic trend data graphical plot.
      l. Must be able to run multiple plots simultaneously.
      m. Program editing.
6. Security: Operator-specific password access protection shall be provided to allow the administrator/manager to limit users’ workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password.

7. The operator interface software shall also include an application to track the actions of each individual operator, such as alarm acknowledgement, point commanding, schedule overriding, database editing, and logon/logoff. The application shall list each of the actions in a tabular format, and shall have sorting capabilities based on parameters such as ascending or descending time of the action, or name of the object on which the action was performed. The application shall also allow querying based on object name, operator, action, or time range.

8. Dynamic Color Graphics application shall include the following:
   a. Shall include graphic editing and modifying capabilities.
   b. A library of standard control application graphics and symbols must be included.
   c. Shall be able to command points directly off graphics application.
   d. Graphic display shall include the ability to depict real-time point values dynamically with animation, picture/frame control, symbol association, or dynamic informational text-blocks.
   e. Graphics shall be capable of displaying the status of points that have been overridden.

9. Reports shall be generated on demand or via pre-defined schedule, and directed to CRT displays, printers or file.

10. Scheduling and override
    a. Provide a calendar type format for simplification of time and date scheduling and overrides of building operations. Schedule definitions reside in the PC workstation and in the Building Controller to ensure time equipment scheduling when PC is off-line, PC is not required to execute time scheduling. Provide override access through menu selection, graphical mouse action or function key. Provide the following capabilities as a minimum:
        1) Daily, Weekly, and Monthly schedules
        2) Ability to combine multiple points into a logical grouping (Zone) for ease of scheduling (e.g., Building 1 lights)
        3) Ability to combine multiple groups of points into a common collection (Event) for scheduling (e.g., Building 1 and Parking Lot A lights)
        4) Schedule predefined reports that can be sent to a printer, hard drive location, or emailed.

11. Collection and Analysis of Historical Data
    a. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals or change of value, both of which shall be user-definable. Trend data shall be collected and stored on hard disk for future diagnostics and reporting.
b. Panels shall have a trending level above which the data will be automatically uploaded to the BMS server to prevent overwriting the data in the field panel.

c. Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of selected points.

d. Provide additional functionality that allows the user to view real-time trend data on trend graphical plot displays. The dynamic graphs shall continuously update point values. At any time the user may redefine sampling times or range scales for any point.

12. Dynamic Color Graphic Displays

a. Capability to create color graphic floor plan displays and system schematics for each piece of mechanical equipment, including, but not limited to, air handling units, chilled water systems, hot water boiler systems, and room level terminal units.

b. The operator interface shall have the ability to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, point alarm association, or text-based commands. Graphics software shall permit the importing of AutoCAD or scanned pictures for use in the system.

c. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations within the system schematics or graphic floor plan displays, and shall automatically update to represent current conditions.

C. System Configuration & Definition

1. A “Collapsible tree” dynamic system architecture diagram/display application of the site-specific BMS architecture showing status of controllers, PC workstations and networks shall be provided. This application shall include the ability to add and configure workstations, Building Controllers, as well as third-party integrated components. Symbols/Icons representing the system architecture components shall be user-configurable and customizable, and a library of customized icons representing third-party integration solutions shall be included. This application shall also include the functionality for real-time display, configuration and diagnostics connections to Building Controllers.

2. Network wide control strategies shall not be restricted to a single Building Controller, but shall be able to include data from any and all other network panels to allow the development of Global control strategies.

3. Provide automatic backup and restore of all Building Controller databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate Building Controller. Changes made at the user-interface of Building Controllers shall be automatically uploaded to the workstation, ensuring system continuity.

4. System configuration, programming, editing, graphics generation shall be performed on-line.

5. User shall be able to edit point configuration online within a dedicated editor application that is part of the operator interface software. The editor shall allow the user to create, view existing, modify, copy, and delete points from the database.
6. The point editor shall have the capability to assign “informational text” to points as necessary to provide critical information about the equipment.

7. The point editor shall also allow the user to configure the alarm management strategy for each point. The editor shall provide the option for editing the point database in an online or offline mode with the Building Controllers.

8. Control program configuration shall be available to the user within a dedicated control program editor application included in the operator interface software. The editor shall allow for creation, modification and deletion of control programs. The editor shall include a programming assistance feature that interactively guides the user through parameters required to generate a control program. The editor shall also include the ability to automatically compile the program to ensure its compatibility with the Building Controllers. The editor shall provide the option for editing the control programs in an online or offline mode, and also the ability to selectively enable or disable the live program execution within the Building Controllers.

9. Users shall have the ability to view the program(s) that is/are currently running in a Building Controller. The display shall mark the program lines with the following: disabled, comment, unresolved, and trace bits.

D. Alarm Management
1. Provide alarm notifications for all major HVAC equipment including air handling units, heat pumps, chillers, boilers, pumps, fans, rooftop units, etc. Verify alarm notification requirements with the Owner. Typical alarm notifications shall include but not be limited to fan/pump failures, temperature setpoint failures, building pressure, hot water temperature, chilled water temperature, alarms from manufacturer-provided BACnet controllers, etc.

2. Alarm Routing shall allow the user to send alarm notification to selected printers, email addresses, text message addresses or workstation location(s) based on time of day, alarm severity, or point type.

3. Alarm messages shall be customizable for each point, or each alarm priority level, to display detailed instructions to the user regarding actions to take in the event of an alarm.

E. Remote notification of messages
1. Operator Interface software shall be configured to send out messages to phones, text messaging devices, and email accounts based on a point’s alarm condition.

2. System must be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.

3. Message detail shall be configurable on a per user basis.

2.4 REMOTE WEB APPLICATION OPERATOR INTERFACE
A. The BAS shall provide a web based graphical interface that allows users to access the BAS data via the Internet, extranet, or Intranet. The interface shall use HTML based ASP pages to send and receive data from the BAS to a web browser.

B. Furnish and install a web server computer complete with the most current operating system software.

C. Access to the web interface shall be password protected. A users rights and privileges to points and graphics shall be the same as those assigned at the OWS.
D. All graphics available at the OWS shall be available to users via a web browser.

E. The web-based interface shall provide the following functionality to users, based on their access and privilege rights:

F. Logon Screen – allows the user to enter their user name, password and Domain name for logging into the web server.

G. Alarm Display – a display of current BAS alarms to which the user has access shall be displayed. Users shall be able to acknowledge and erase active alarms, and link to additional alarm information including alarm messages, and informational and memo text. Any alarm acknowledgements initiated through the web interface shall be written to the BAS central workstation activity log.

H. Graphic Display – display of system graphics available in the BAS workstation shall be available for reviewing over the web browser. A graphic selector list shall allow users to select any graphics to which they have access. Graphic displays shall automatically refresh with the latest change of values. Users shall have the ability to command and override points from the graphic display as determined by their user accounts rights.

I. Point Details – users shall have access to point detail information including operational status, operational priority, physical address, and alarm limits, for point objects to which they have access rights.

J. Point Commanding – users shall be able to override and command points they have access to via the web browser interface. Any commands or overrides initiated via the web browser interface shall be written to the BAS central workstation activity log.

K. Remote Communications: Provide a communication port for connection to the BAS network for remote web based communications. Provide coordination with the Owner for addressing and router configuration on both ends of the remote network.

L. The web server licensing options shall allow concurrent access by 5 browser connections.

M. Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the BAS Contractor for the duration of the warranty period as required to support the web access feature.

2.5 GRAPHICS

A. Floor Plan Graphics

1. The BAS contractor shall request floor plans to be used as a background for a floor graphic.

2. If the floor plan to too big for the Graphical screen, provide a zoom feature or breakdown the floor into areas.

3. The floor plan shall, at a minimum, indicate each zone temperature setpoint and current temperature.

B. Equipment Graphics

1. The BAS Contractor shall provide a graphical screen for each individual air handling unit, pumping system, heating system, cooling system and terminal unit. Each graphic shall accurately depict the system components in a schematic format and shall include the setpoint and actual condition of all available temperature, pressure, flow and status points in the system.

2. Adjustable or override points shall be clearly displayed and shall be capable of being adjusted without leaving the graphics page.
2.6 STANDARD APPLICATION PROGRAMS

A. Morning warm up:
   1. The system shall start at a predefined time prior to the system entering the occupied cycle of operation to facilitate the raising or lowering of the building temperature to bring the building back to occupied temperature.

B. Optimal start:
   1. The system shall calculate the optimal time to start the morning warm up process to assure that the building reaches occupied temperature as close to the occupied time as possible.

C. Scheduled occupied/unoccupied:
   1. The system shall enter occupied or unoccupied cycle as determined by a time of day, day of week schedule.

D. Sensed occupied/unoccupied:
   1. The system shall enter the occupied or unoccupied cycle as determined by a room occupancy sensor. The room occupancy sensor is furnished and installed by the Electrical Contractor. Interlock wiring between the sensor and the controller is furnished and installed by the BAS Contractor.

E. Dry bulb economizer:
   1. Whenever the outdoor air temperature is below the return air temperature and there is a call for cooling the system shall allow the outside air dampers to modulate prior to allowing mechanical cooling to activate.
   2. The outside air damper shall return to minimum whenever the outside air temperature is above the return air temperature.

F. Enthalpy economizer:
   1. Whenever the outdoor air total energy is below the return air total energy and there is a call for cooling the system shall allow the outside air dampers to modulate prior to allowing mechanical cooling to activate.
   2. The outside air damper shall return to minimum whenever the outside air total energy is above the return air total energy.

G. Dead band:
   1. Where used to control both heating and cooling, zone temperature controls shall provide a temperature range or dead band within which the supply of heating and cooling energy to the zone is capable of being shut off or reduced to a minimum.

H. Night set-back:
   1. Whenever the system is in the unoccupied cycle the room heating temperature setpoint shall be set-back to a reduced night temperature. The night set-back temperature shall be globally or individually set through the BAS.

I. Night set-up:
   1. Whenever the system is in the unoccupied cycle the room cooling temperature setpoint shall be set-up to an increased night temperature. The night set-up temperature shall be globally or individually set through the BAS.

J. Supply air reset:
1. The system shall reset the supply air temperature setpoint based on the reheat coil valve position of each vav box served by the system. The DDC control program shall reset the supply air temperature from 55 deg. F. to 65 deg. F. The supply air temperature setpoint shall be reset up whenever all reheat coil valves are open at least 15%, The supply air temperature setpoint shall be reset down whenever any one reheat coil valve is fully closed.

K. Static pressure reset:
   1. The system shall reset the static pressure setpoint based on the damper position of each vav box served by the system. The DDC control program shall gradually reset the static pressure setpoint down whenever all vav boxes are no more than 75% open. The DDC control program shall gradually reset the static pressure setpoint up whenever any vav box reaches 90% open.
   2. The static pressure shall reset between minimum and maximum setpoints in increments of .1” water column at 10 minute intervals. Obtain minimum and maximum static pressure setpoints from the balancing contractor.

L. Hot water reset:
   1. The system shall reset the hot water temperature setpoint based on outside air temperature. As the outside air temperature drops the hot water temperature setpoint shall rise.

M. Chilled water reset:
   1. The system shall reset the chilled water temperature setpoint based cooling coil valve position of each cooling unit served by the system. The DDC control program shall reset the chilled water supply temperature from 45 deg. F. to 55 deg. F. The chilled water supply temperature setpoint shall be reset up whenever all cooling coil valves are no more than 75% open. The chilled water supply temperature setpoint shall be reset down whenever any one cooling coil valve reaches 90% open.
   2. The chilled water temperature shall reset between minimum and maximum setpoints in increments of 1 deg. F. at 10 minute intervals.

N. Pressure differential reset:
   1. The system shall reset the pressure differential setpoint based on the automatic control valve position of each heating or cooling unit served by the system. The DDC control program shall gradually reset the pressure differential setpoint down whenever all control valves are no more than 80% open. The DDC control program shall gradually reset the pressure differential setpoint up whenever any one valve reaches 90% open.
   2. The pressure differential setpoint shall reset between minimum and maximum setpoints in increments of .5 psig at 10 minute intervals. Obtain minimum and maximum pressure differential setpoints from the balancing contractor.

2.7 BUILDING LEVEL SYSTEM CONTROLLERS

A. Provide this type of controller for controlling:
   1. Rooftop Air Conditioning Units.
   2. Integration to auxiliary systems such as Lighting, Power Monitoring, etc.

B. BACnet Compliance: Control units shall use ASHRAE 135 protocol.

C. Modular, comprising processor board with programmable, nonvolatile, random-access memory; and backup power source.
D. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.

E. Stand-alone mode control functions operate regardless of network status. Functions include the following:
1. Global communications.
2. Discrete/digital and analog I/O.
3. Monitoring, controlling, or addressing data points.
4. Software applications, scheduling, and alarm processing.
5. Testing and developing control algorithms without disrupting field hardware and controlled environment.

F. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.

G. I/O Interface: Hardwired inputs and outputs may tie into system through controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
3. Binary Outputs: Provide on-off low-voltage signal, selectable for normally open or normally closed operation.
4. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
5. Universal I/Os: Provide software selectable binary or analog outputs.

2.8 ADVANCED APPLICATION CONTROLLERS
A. Provide this type of controller for controlling:
1. Packaged HVAC Units with integral BACnet controllers.
2. Miscellaneous small point count applications that require custom sequences.

B. BACnet Compliance: Control units shall use ASHRAE 135 protocol.

C. Self-contained unit, comprising of processor board with programmable, nonvolatile, random-access memory; integral interface equipment; and backup power source.

D. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.

E. Stand-alone mode control functions operate regardless of network status. Functions include the following:
1. Global communications.
2. Discrete/digital and analog I/O.
3. Monitoring, controlling, or addressing data points.
4. Software applications, scheduling, and alarm processing.
5. Testing and developing control algorithms without disrupting field hardware and controlled environment.

F. I/O Interface: Hardwired inputs and outputs may tie into system through controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
3. Binary Outputs: Provide on-off low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
4. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
5. Universal I/Os: Provide software selectable binary or analog outputs.

2.9 APPLICATION SPECIFIC CONTROLLERS

A. Provide this type of controller for controlling:
   1. Cabinet Heaters
   2. Fan coils
   3. Fans
   4. Remote point pickup

B. Controller:
   1. Each Building Controller shall be able to communicate with application specific controllers (ASCs) over the subnetwork to control terminal equipment only.
   2. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network.
   3. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.
   4. Each ASC shall include all point inputs and outputs necessary to perform the specified control sequences. The ASC shall accept input and provide output signals that comply with industry standards. Controllers utilizing proprietary control output signals shall not be acceptable. Outputs utilized either for two-state, or proportional control, allowing for additional system flexibility.
   5. Communication. Each controller shall perform its primary control function independent of the network and other controllers. Controllers that depend on communication to master controllers or revert to a fail-safe mode of operation during subnetwork interruption are not acceptable.

C. Control Algorithms. The controller shall receive its real-time data from the Building Controller time clock to ensure Secondary Network continuity. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) gains for all applications. All PID gains and biases shall be field-adjustable at the operator workstation.

D. Control Applications. Operating programs shall be field-selectable for specific applications. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.

E. Programmability. Application Specific Controllers shall be programmable, using software provided by the BMS manufacturer. Software shall be field-installable on any standard laptop or Portable Operator's Terminal. Program language shall be text-based and allow up to 200 lines of code for programming. Programming shall allow for changing sequence
of operation, commanding and releasing points, additional monitoring, and command
priority management within the Application Specific Controller.

F. Memory.
1. Provide each ASC with sufficient memory to accommodate point databases,
   operating programs, local alarming and local trending. All databases and
   programs shall be stored in non-volatile EEPROM, EPROM and PROM, or
   minimum of 72-hour battery backup shall be provided. The controllers shall be
   able to return to full normal operation without user intervention after a power
   failure of unlimited duration.

G. Upon replacement, new ASCs shall recover control function and site specific defaults
   automatically and resume normal operation.

2.10 ELECTRONIC SENSORS
A. Room Temperature Sensors
1. Flush Plate Temperature Sensors – Wired: Where called for in the sequences or
   on the drawings, provide sensors with stainless steel plate face flush mounted in
   the wall.
2. Plain Space Temperature Sensors – Wired: Where called for in the sequences or
   on the drawings, provide sensors with plain covers.
3. Digital Display Space Temperature Sensors – Wired: Where called for in the
   sequences or on the drawings, provide sensors with digital displays.
4. Wireless Space Temperature Sensors: Where called for in the sequences or on
   the drawings, provide wireless sensors with plain or digital display covers as
   indicated.
5. The sensing element for the space temperature sensors shall be thermistor type
   providing the following.
   a. Element Accuracy: + /- 1.0°F
   b. Operating Range: 55 to 95°F
   c. Set Point Adjustment Range: 55 to 95°F
   d. Calibration Adjustments: None required
   e. Auxiliary Communications Port: As required
6. The digital display shall provide the following.
   a. Display of temperature setpoint with numerical temperature values.
   b. Display of room temperature with numerical temperature values.
   c. Display of active occupied/unoccupied status.
   d. Occupied/unoccupied override.
7. Wireless space temperature sensors shall be 10K Ohm Thermistor or equivalent
   type providing the following.
   a. Accuracy: + .5°F
   b. Operating Range: 55 to 95°F
   c. Monitoring Range: 55 to 95°F
   d. Battery life: Minimum 3 years
e. Auxiliary Communications Port: as required

8. All sensors shall be mountable to and fully covering a standard 2x4 electrical junction box without the need for an adapter wall plate.

9. Provide the following options as they are called for in the sequences or on the drawings:

10. Setpoint adjustment. The setpoint adjustment function shall allow for modification of the temperature by the building operators. Setpoint adjustment may be locked out, overridden, or limited as to time or temperature range through software by an authorized operator at any central workstation.

11. Occupied/unoccupied override. An override button shall initiate override of the night setback mode to normal (day) operation when activated by the occupant and enabled by building operators. The override shall be limited to two (2) hours (adjustable.) The override function may be locked out, overridden, or limited through software by an authorized operator at any central workstation.

B. Space Humidity Sensors

1. Space humidity sensors shall have the same appearance as the space temperature sensors. Humidity elements shall measure relative humidity with a +/- 2% accuracy over the range of 10 to 90% relative humidity. Humidity element shall be an IC (integrated circuit) sensing element. Humidity sensing elements shall be removable and field replaceable if needed.

C. Thermistor Temperature Sensors and Transmitters:

1. Accuracy: Plus or minus 0.5 deg. F at calibration point.

2. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.

3. Averaging Elements in Ducts: 36 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft.

4. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.

5. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

D. Pressure Transmitters/Transducers:

1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
   a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
   b. Output: 4 to 20 mA.
   c. Building Static-Pressure Range: 0 to 0.25-inch wg.
   d. Duct Static-Pressure Range: 0 to 5-inch wg.

2. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150 psig operating pressure; linear output 4 to 20 mA.

3. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psi operating pressure and tested to 300-psi; linear output 4 to 20 mA.

4. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
5. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

E. Room sensor accessories include the following:

1. Insulating Bases: For sensors located on exterior walls.

F. CO2 SENSORS

1. Provide indoor air quality sensors to monitor Carbon Dioxide (CO2) and/or Volatile Organic Compound (VOC) levels.

2. The CO2 sensor shall be of microprocessor-based non-dispersive infrared type.

3. The CO2 sensors shall have no more than 1% drift during the first year of operation and minimal drift thereafter so that no calibration will be required.

4. The units shall be wall or duct mounted type as indicated on plans and in the sequence of operation.

5. Wall mounted sensors shall be provided with white plastic cover, without LED indicators.

6. Duct mounted sensors shall be provided without the need for a separate aspirator box.

7. The VOC sensor shall have automatic self calibrating capability to ensure accuracy.

8. The sensor shall meet the following requirements:

   a. Operating voltage: 24 Vac +/- 20%
   b. Frequency: 50/60 Hz
   c. Power consumption: max. 6 VA
   d. CO2 measuring range: 0 – 2000 ppm
   e. Tolerance: +/- 100 ppm
   f. Output: 0 – 10 Vac
   g. Calibration: none required
   h. VOC measurement range: 0 – 10V VOC

2.11 DUCT SMOKE DETECTORS

A. Shall be UL listed of the solid state photoelectric type and shall operate on the light scattering photodiode principle. The detectors shall be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive materials shall be used. Detector construction shall be of the split type, that is, mounting base with twist-lock detecting head. Contacts between the base and head shall be of the bifurcated type using spring-type, self-wiping contacts. Duct housing couplings shall be slotted to insure proper alignment of the sampling and exhaust tubes. Detector shall have an alarm LED visible through a transparent front cover.

B. Provide additional dry contact for fire alarm interface.

C. Installation must comply with NFPA-90A.

2.12 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.
B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

2.13 FREEZE PROTECTION THERMOSTATS

A. Snap-acting, single-pole, single-throw, automatic reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
   2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
   3. Location: Downstream face of the heating coil.

2.14 DAMPERS

A. Automatic dampers shall be furnished by the BAS Contractor but shall be set in place by the Mechanical Contractor. Dampers shall be of the balanced type with a maximum blade width of 8" and length of 48". Damper frames shall be galvanized sheet metal or aluminum with nylon or sintered bronze oil impregnated bearings.

B. Dampers for proportioning control shall have opposed blade action. Dampers for two position, open-closed control shall have parallel blade action.

C. Damper blades shall have interlocking edges with compressible seals on both blade edges and ends. Dampers, when closed, shall be guaranteed by the manufacturer not to leak air in excess of 6 CFM/sq. ft. at 4" water gauge static pressure.

2.15 ACTUATORS

A. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
   2. Dampers: Size for running torque calculated as follows:
      b. Opposed-Blade Damper: 5 inch-lb/sq. ft. of damper.
      c. Dampers with 2 to 3 inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
2.16 CONTROL VALVES

A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

B. Hydronic system globe valves shall have the following characteristics:
   1. NPS 2” and Smaller: Class 125 and 250 degrees F bronze body, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
   2. NPS 2-1/2” and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
   3. Internal Construction: Replaceable plugs, stainless-steel or brass seats.
   4. Sizing: 3-psig maximum pressure drop at design flow rate.
   5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
   6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head.

C. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, cast-iron or ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
   1. Body Style: Full lug
   2. Disc Type: Nickel-plated ductile iron.
   3. Sizing: 3-psig maximum pressure drop at design flow rate.

D. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, union, and threaded ends.
   1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.

3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

PART 3 - EXECUTION

3.1 GENERAL

A. All necessary equipment, labor and materials not specifically indicated or specified, but necessary to complete work, are to be provided as part of the contract.

B. Install all control equipment, accessories, wiring, and piping in a neat and workmanlike manner. All control devices must be installed in accessible locations.

C. All sensors and control devices that are to be installed within a classified/rated area shall be provided with the appropriate rating for the space in which they are located.

D. Provide all electrical relays and wiring, line and low voltage, for control systems, devices and components. Install all wiring in accordance with electrical sections (Division 26) of this specification and the National Electrical code.

E. Control panels serving equipment fed by emergency power shall also be served by emergency power.

3.2 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermostats, humidistats, and other exposed control sensors with drawings and room details before installation. Install devices per ADA requirements.

D. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. All sensor and output wiring shall be shielded cable or per manufacturers specifications which must be furnished upon request.

B. The field wiring connections of all field-mounted sensors shall be adequately protected by a junction box mounted at the point of measurement.

C. In addition to requirements of electrical sections (Division 26), all exposed low voltage wiring (less than 120 V) provided by this Contractor shall be enclosed in conduit. All 120 volt wiring shall be enclosed in EMT conduit. No flexible conduit shall be allowed for 120 volt wiring.

D. Separate conduit systems shall be provided for low voltage and line voltage wiring.

E. All wiring and conduit shall be secured at regular intervals and run parallel with the lines of the building.

3.4 CONTROL VALVES

A. All temperature control valves furnished by the BAS Manufacturer are to be installed by the Mechanical Contractor under the coordinating control and supervision of the BAS Contractor in locations shown on plans or where required to provide specific sequence of control.
3.5 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.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.

2. Test and adjust controls and safeties.

3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.

4. Test each point through its full operating range to verify that safety and operating control set points are as required.

5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.

6. Test each system for compliance with sequence of operation.

7. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.

2. Check instruments for proper location and accessibility.

3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.

4. Check instrument tubing for proper fittings, slope, material, and support.

5. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.

6. Check temperature instruments and material and length of sensing elements.

7. Check control valves. Verify that they are in correct direction.

8. Check DDC system as follows:

   a. Verify that DDC controller power supply is from emergency power supply, if applicable.

   b. Verify that wires at control panels are tagged with their service designation and approved tagging system.

   c. Verify that spare I/O capacity has been provided.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.6 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.

2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer’s written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.

4. Control System Inputs and Outputs:
   a. Check analog inputs at 0, 50, and 100 percent of span.
   b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
   c. Check digital inputs using jumper wire.
   d. Check digital outputs using ohmmeter to test for contact making or breaking.
   e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:
   a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
   b. Manually operate flow switches to verify that they make or break contact.

6. Pressure:
   a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
   b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.

7. Temperature:
   a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
   b. Calibrate temperature switches to make or break contacts.

8. Stroke and adjust control valves and dampers without positioners, following the manufacturer’s recommended procedure, so that valve or damper is 100 percent open and closed.

9. Stroke and adjust control valves and dampers with positioners, following manufacturer’s recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.

10. Provide diagnostic and test instruments for calibration and adjustment of system.

11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to demonstrate and train Owner’s maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls as specified below.

1. Train Owner’s maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
2. Schedule training with owner with at least 3 days' notice.

3. Provide operator training on data display, alarm and status descriptors, requesting data, execution of commands, and request of logs. Include a minimum of 12 hours' dedicated instructor time on-site.

4. Provide screen capture software with audio capture for Owner use.

5. Additional instruction time as deemed necessary by the Owner shall be obtained from the BAS Contractor on a negotiated basis with the Owner.

End Section 23 09 00
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 RELATED WORK
A. 23 09 00 Building Automation System

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 CABINET HEATER
A. Control programs
1. Scheduled occupied/unoccupied.
2. Dead band.
B. Control devices for each unit.
1. Application Specific Controller.
2. Room temperature sensor – Plain cover type.
3. Three way heating coil valve and normally open modulating operator.
4. Coil discharge air temperature sensor.
5. Relay for fan motor control.
C. Control Sequence.
1. The DDC control program shall modulate the coil valve to maintain room temperature setpoint. The coil discharge air temperature sensor shall be mounted above the unit coil and shall start the unit fan motor on a rise in unit coil leaving air temperature.

3.2 CONVECTOR
A. Control programs
1. Scheduled occupied/unoccupied.
2. Dead band.
B. Control devices for each unit.
1. Application Specific Controller.
2. Room temperature sensor – Plain cover type.
3. Two way heating coil valve and normally open modulating operator.
C. Control Sequence
1. The DDC control program shall modulate the valve to maintain room temperature setpoint.
3.3 SINGLE ZONE VARIABLE AIR VOLUME ROOFTOP AIR CONDITIONING UNITS

A. Equipment served
   1. RTU-1 through RTU-3

B. Control programs
   1. Morning warm up.
   2. Optimal start.
   3. Dead band.
   5. Enthalpy economizer.
   7. Night set-up.

C. Control devices for each unit (by BAS Contractor except as noted)
   1. Building Level System Controller
   2. Room temperature sensor – Plain cover type.
   3. Return air humidity sensor.
   4. Building pressure sensor.
   5. CO₂ sensor.
   7. Filter air pressure drop differential sensor.
   8. Fan status feedback.

D. Occupied Cycle
   1. The DDC control program shall enable the unit.
   2. The unit supply fan motors shall start at minimum speed and the outside air and
      return air dampers shall slowly open to their minimum position whenever the unit
      is scheduled to the occupied cycle.
   3. Heating Mode:
      a. When the system is in the heating mode, the DDC control program shall
         modulate the gas heating section and modulate the fan speed as
         required to maintain room temperature setpoint. On a call for maximum
         heat the gas heating section shall modulate as required to maintain
         maximum heating discharge air temperature setpoint. On a reduced call
         for heat the fan shall modulate from full air flow to minimum air flow. On a
         further reduction in the call for heat the heating discharge air temperature
         setpoint shall reset from max heating to room air temperature. On an
         increase for heating demand the reverse shall occur.
   4. Cooling Mode:
      a. When the system is in the cooling mode, the DDC control program shall
         modulate the economizer dampers, sequence stages of mechanical
         cooling and modulate the fan speed as required to maintain room
temperature setpoint. On a call for maximum cooling the economizer dampers shall modulate and the stages of mechanical cooling shall cycle as required to maintain minimum cooling discharge air temperature setpoint. On a reduced call for cooling the fan shall modulate from full air flow to minimum air flow. On a further reduction in the call for cooling the cooling discharge air temperature setpoint shall reset from max cooling to room air temperature. On an increase for cooling demand the reverse shall occur.

b. There shall be an adjustable deadband or timed delay between stages of cooling to prevent short cycling of the refrigeration compressors.

5. As the unit control program modulates the variable frequency drives, the outside air damper shall also modulate to maintain a constant minimum flow of outside air as indicated on the plans.

6. The DDC control program shall modulate the variable frequency drive serving the relief fan as required to maintain building static pressure setpoint. (+0.03” w.c., adj.)

E. Dehumidification Cycle

1. Whenever the return air humidity exceeds high limit setpoint the control program shall initiate the hot gas dehumidification control sequence.

2. When the return air humidity falls below high limit setpoint the control program shall revert back to normal control.

F. Unoccupied Cycle

1. The fan motors shall cycle intermittently, at night set-back/pull-down temperatures, with the outside air damper closed whenever the room sensor calls for heating or cooling. When the night set-back/pull-down room temperature has been satisfied the unit shall stop.

G. General

1. The outside air damper shall close whenever the unit fan motors are off.

2. The auto reset freeze protection thermostat shall stop the unit fan motors whenever the unit discharge temperature drops below 35 deg. F.

3. The relief damper shall close and the relief fan shall be off whenever the unit fan motor is off.

4. The smoke detector shall be located in the return air duct and shall stop the unit fan motors whenever smoke is present.

5. The outside air damper shall modulate toward the increased minimum position whenever the CO₂ concentration exceeds setpoint (800 ppm adj.) or the unit is scheduled for “Event” mode.

3.4 FAN COIL UNIT

A. Control programs

1. Morning warm up.

2. Optimal start.

3. Dead band.


B. Control devices for each unit
1. Advanced Application Controller.
2. Outside air damper and normally closed two-position damper operator.
3. Return air damper and normally open modulating damper operator.
4. Two way heating coil valve and normally open modulating operator.
5. Relays for fan motor control.
6. Room temperature sensor – Digital display type.
7. Discharge air temperature sensor.
8. Freeze protection thermostat.

C. Occupied Cycle
1. The control shall function so that the unit fan motor starts whenever DDC control program is indexed to the “occupied” cycle.
2. The outside air, and return air dampers shall open to their minimum position.
3. The DDC control program shall, in sequence, modulate the heating coil valve to maintain setpoint of the room sensor.

D. Unoccupied Cycle
1. The fan motor shall cycle intermittently with the outside air damper closed whenever the room sensor calls for heat.

E. General
1. The outside air damper shall close whenever the unit fan motor is off.
2. The freeze protection thermostat shall stop the unit fan motor whenever the unit discharge temperature drops below 35 deg. F.

3.5 ROOF EXHAUST FANS – SCHEDULED OCCUPIED/UNOCCUPIED
A. Fans served
1. RE-1.

B. Control programs
1. Scheduled occupied/unoccupied.

C. Control devices for each unit.
1. Application Specific Controller.
2. Fan status.
3. Relay for control of the exhaust air damper and damper operator furnished with the fan.

D. Control Sequence
1. The DDC control program shall open the exhaust air damper and start the unit fan motor whenever the system is scheduled to the occupied cycle.
3.6  IN-LINE EXHAUST FANS – SCHEDULED OCCUPIED/UNOCCUPIED
A.  Fans served
   1.  IF-1.
B.  Control programs
   1.  Scheduled occupied/unoccupied.
C.  Control devices for each unit.
   1.  Application Specific Controller.
   2.  Fan status.
   3.  Exhaust air damper and two position damper operator.
D.  Control Sequence
   1.  The DDC control program shall open the exhaust air damper and start the unit
       fan motor whenever the system is scheduled to the occupied cycle.

3.7  DESTRATIFICATION FANS
A.  Fans served
   1.  DS-1 and DS-2.
B.  Control devices for each unit.
   1.  Application Specific Controller.
   2.  Upper level space temperature sensor.
   3.  Room temperature sensor.
C.  Control programs
   1.  Scheduled occupied/unoccupied.
D.  Occupied Cycle
   1.  The destratification fans shall run when the space is in the occupied mode.
E.  Unoccupied Cycle
   1.  The destratification fans shall be off when the system enters the unoccupied
       cycle.
   2.  On a call for heat in the space the DDC control program shall compare the
       temperature near the ceiling with the room temperature. If the temperature near
       the ceiling is higher than the room temperature the DDC control program shall
       start the destratification fans as the first stage of heat.
   3.  After a time delay of 30 minutes (adj.), if there is still a call for heating the rooftop
       units shall enter the unoccupied heating cycle (see RTU-1 and RTU-2 control).
       When the unoccupied room temperature setpoint has been satisfied the
       destratification fans shall stop.

End Section 23 09 93
23 20 01 PIPE AND PIPE FITTINGS

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 REFERENCE STANDARDS
A. ANSI B16.5 - Pipe Flanges and Flanged Fittings
B. ASTM A53 - Pipe, Steel, Black & Hot Dipped, Zinc Coated Welded & Seamless
C. ASTM B75 - Seamless Copper Tube
D. ASTM B88 - Seamless Copper Water Tube
E. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
F. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing & Fittings

1.3 QUALITY ASSURANCE
A. Order all Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on the size of the pipe, and in accordance with the appropriate ASTM specification.
B. Order all copper water tube with each length marked with the name or trademark of the manufacturer and type of tube; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier; all in accordance with ASTM B88.
C. Order all copper refrigeration tube with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier; with soft straight lengths or coils identified with a tag indicating that the product was manufactured in accordance with ASTM B280; and with each hard temper straight length identified throughout its length by a blue colored marking not less than 3/16 inch in height and a legend at intervals of not greater than three feet that includes the designation “ACR” and pipe outside diameter.
D. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.4 DESIGN CRITERIA
A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.
B. Construct all piping for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 PSIG unless specifically indicated otherwise.
C. Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in occupied spaces and ventilation plenum spaces, including plenum ceilings.
D. Where ASTM A53 type F pipe is specified, ASTM A53 grade A type E or S, or ASTM A53 grade B type E or S may be substituted at Contractor’s option. Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor’s option. Where the grade or type is not specified, Contractor may choose from those commercially available.
E. Where ASTM B88, type L hard temper copper tubing is specified, ASTM B88, type K hard temper copper tubing may be substituted at Contractor’s option.
PART 2 - PRODUCTS

2.1 HEATING HOT WATER
A. Two inch (2”) and Smaller: ASTM A53, type F, standard weight (Schedule 40) black steel pipe with ASTM A126/ANSI B16.4, Class 125, standard weight cast iron threaded fittings.
B. Where vertical branch piping runs in general construction, provide single piece ASTM B-88 type “K” soft temper copper tubing. Wrought copper sweat fittings and silver soldered joints shall be used at connections to mains and to equipment.
C. The Contractor, at his option, may use ASTM B88 seamless, Type L, hard temper copper tube with ANSI B16.22 wrought copper solder-joint fittings or mechanical press couplings and fittings, Viega or Nibco, in lieu of steel pipe for all hot water piping 2” and smaller.

2.2 NATURAL GAS
A. Two inch (2”) and Smaller: ASTM A53, type F, standard weight (Schedule 40) black steel pipe with ASTM A197/ANSI B16.3, Class 150 black malleable iron threaded fittings or ASTM A234 grade WPB/ANSI B16.9 standard weight, ERW, carbon steel weld fittings.

2.3 REFRIGERANT
A. ASTM B88 type L hard drawn copper tube, cleaned and capped in accordance with ASTM B280, and marked “ACR”, with ANSI B16.22 wrought copper or forged brass solder-type fittings.

2.4 DRAIN PIPING

2.5 AIR VENTS
A. ASTM B-88 type “L” 1/8 nominal size copper tubing with wrought copper sweat fittings with 95/5 soldered joints.

2.6 UNIONS AND FLANGES
A. Two inch (2”) and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Use unions of a pressure class equal to or higher than that specified for the fittings of the respective piping service.

PART 3 - EXECUTION

3.1 PREPARATION
A. Remove all foreign material from interior and exterior of pipe and fittings.

3.2 ERECTION
A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings or other details before installing piping.
B. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.
C. Mitered ells, notched tees, bull-head tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.
D. “Weldolets” and “Threadolets” may be used for branch takeoffs up to one-half (1/2) the diameter of the main.
E. Install drains throughout the systems to permit complete drainage.
F. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.
G. Install all valves, control valves, and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.
H. Caulk around all piping passing through all walls, ceilings and floors. For fire rated walls use United States Gypsum Thermafiber 4” thick and G.E. Pensil silicone foam sealant per plan detail. For non-rated walls fiberglass insulation may be used in lieu of the Thermafiber. For plenum walls, the penetration shall be treated as a one hour fire rated wall.
I. Install manual air vents at all high points within the hot water system.
J. Install a bronze coupler at all locations where copper and steel piping are to meet.

3.3 THREADED PIPE JOINTS
A. Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.4 COPPER PIPE JOINTS
A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with emery cloth or sandpaper. Remove residue from the cleaning operations, apply flux, and assemble joint. Use 95-5 solder or brazing to secure joint as specified for the specific piping service.
B. Follow mechanical press joint manufacturer’s installation recommendations for installation of all mechanical press couplings and fittings.

3.5 HOT WATER
A. Run water mains level or pitch horizontal mains up 1 inch in 40 feet in the direction of flow. Install manual air vents at all high points where air may collect. If vent is not in an accessible location, extend air vent piping to the nearest code acceptable drain location with vent valve located at the drain.
B. Main branches and runouts to terminal equipment may be made at the side or bottom of the main provided that there are drain valves suitably located for complete system drainage and manual air vents are located as described above.
C. Connections at a main may be made with a tee and a 90 degree or 45 degree elbow.
D. Use a minimum of two elbows in each pipe line to a piece of terminal equipment to provide flexibility for expansion and contraction of the piping systems. Offset pipe connections at equipment to allow for service, such as removal of the terminal device.
E. Use eccentric fittings for changes in horizontal pipe sizes with the fittings installed for proper air venting. Concentric fittings may be used for changes in vertical pipe sizes.

3.6 NATURAL GAS
A. Pitch horizontal piping down 1” in 60 feet in the direction of flow. Install a 4” minimum depth dirt leg at the bottom of each vertical run and at each appliance. When installing mains and branches, cap gas tight each tee or pipe end which will not be immediately extended. All branch connections to the main shall be from the top or side of the main.
B. Do not install gas pipe below a building or its foundation or in a ventilation air plenum.
C. If an above ground vent terminates in an area subject to snow accumulation, terminate the line at least five feet above grade.

D. All joints in underground polyethylene gas pipe must be made by qualified personnel proficient in the joining methods of ASTM D2513 thermoplastic gas pressure pipe and polyethylene fittings. Do not install polyethylene gas pipe inside buildings.

E. Install a shut off valve at each appliance. Provide a valved connection at the main for equipment and appliances furnished by others.

F. Piping through a roof shall be run through an approved roof penetration with flashing and counter flashing.

G. Install two (2) vent lines from gas trains on each item of gas fired equipment to outdoor atmosphere. One valve sized vent line connected to the gas vent valve, the other vent line, ½” size, connected to the reference connections on each main and pilot gas pressure regulator and the high and low gas pressure switches and run to outdoor atmosphere. Each gas vent pipe shall be individually piped to outdoor atmosphere. Terminate gas vent piping at the building exterior with a screened vent cap.

H. Test gas piping and/or propane piping for leaks after fabrication as follows: Before appliances are connected, gas piping systems shall stand a pressure of at least 150% of the working pressure but not less than 100 pounds per square inch for a period of not less than 24 hours without a drop in pressure due to leakage. Equipment not rated to withstand the test pressure shall be isolated from the piping system under test. The piping shall be filled with air or inert gas. Oxygen shall never be used. The source of pressure shall be isolated before the pressure tests are made.

I. Paint all gas piping installed outdoors with rust resistive paint of color to match surrounding surfaces.

J. 

3.7 COOLING COIL CONDENSATE

A. Trap each cooling coil drain pan connection with a trap seal of sufficient depth to prevent conditioned air from moving through the piping. Extend drain piping to nearest code approved drain location. Construct trap with plugged tee for cleanout purposes as detailed.

3.8 COOLING THROUGH THE WALL DRAINS

A. End of drain line shall terminate at least 2 inches beyond the exterior face of the wall and the line shall pitch down from connection to termination to provide free drainage.

3.9 REFRIGERANT

A. Refrigeration piping to be installed by firms who are experienced in installation of such piping and in accordance with the requirements of the Wisconsin Administrative Code Section Comm. 45.

B. All solder joints to be ASTM Grade 4 or 5 and have a melting point of approximately 1250 degrees F. Solder impurities shall not exceed 0.15%. Tubing to be new and delivered to the job site with the original mill end caps in place. Clean and polish all joints before soldering. Avoid prolonged heating and burning during soldering. Purge all lines with nitrogen during soldering. Provide manual shut-off and check valves as required.

C. Leak test the system by charging the system to a pressure of 10 PSIG with the same type of refrigerant that will be used in the system. Charge refrigerant into the system through a Sporlan catchall filter-drier. Increase pressure to 300 PSIG with dry nitrogen. Rap all joints with a mallet and check for leaks with an electric leak detector having a
certified sensitivity of at least one ounce per year. Seal any leaks that may be found and retest.

D. After completion of the leak test, evacuate the system with a vacuum pump to 2.5mm Hg. absolute while the system ambient temperature is above 60°F. Charge refrigerant into the system to 0 PSIG, then repeat evacuation to 2.5mm Hg. absolute. Allow system to stand evacuated for at least 12 hours. If no noticeable rise in pressure occurs, the system may be charged. Charge system with new refrigerant through charging valve and filter-drier until bubbles disappear from liquid line sight glass while compressor is in operation.

3.10 UNIONS AND FLANGES

A. Install a union or flange as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

3.11 PIPING SYSTEM LEAK TESTS

A. Verify that the piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test.

B. Conduct pressure test with test medium of air or water. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

C. Do not insulate pipe until it has been successfully tested.

D. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

E. For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking.

F. Measure natural gas system test pressure with a water manometer or an equivalent device calibrated in increments not greater than 0.1 inch water column. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

G. All piping except high pressure steam and high pressure condensate shall be tested with 100 PSIG pressure for a minimum of 8 hours. High pressure steam and high pressure condensate shall be tested at 250 PSIG for 8 hours.

3.12 CLEANING

A. Water Systems:

1. The hot water system shall be cleaned by using a solution of HOH Chemical Co. C-312 liquid cleaner and water in accordance with cleaner manufacturer’s directions.

2. Fill, vent and circulate the system with the solution, heating it to 160 deg. - 180 deg. F, if possible, and circulate at least 24 hours. If heat cannot be provided, dosage of C-312 should be doubled and cleaning solution circulated for 2 days.
3. After circulating, system shall be drained completely, flushed and refilled with fresh water. Before refilling, all strainer baskets shall be removed, cleaned if required, and remounted.

End Section 23 20 01
23 20 02 HVAC VALVES

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 RELATED WORK
   A. 23 09 00 Building Automation System for HVAC

1.3 QUALITY ASSURANCE
   A. Substitution of Materials: Refer to General Conditions of the Contract.

1.4 SHOP DRAWINGS
   A. Include dimensions, capacities, materials of construction, weights, wiring diagrams and appropriate identification for all equipment in this Section.

1.5 DESIGN CRITERIA
   A. Where valves are specified for individual mechanical services (i.e., hot water heating, steam, etc.), all valves shall be of the same manufacturer.

PART 2 - PRODUCTS

2.1 HOT WATER
   A. Manufacturers: Milwaukee Valve Co., Nexus, Nibco, Stockham, or Victaulic.
   B. Ball Valves:
      1. Two inch (2”) and smaller, Nibco T-585-70, Milwaukee Valve Co. BA-100 or Stockham S-216. Complete with two piece bronze body, screwed connections, lever operated handle and stop, chrome plated bronze ball, reinforced Teflon seats and Teflon packing. All suitable for 600 PSI WOG and 150 PSI SWP.

2.2 CALIBRATED BALANCING VALVES
   B. Furnish valves with bronze body with brass ball, differential pressure taps, adjustment knob, indexing pointer and locking stops and positive shut-off. Internal seat rings, drain and purge connection and preformed polyurethane for valve body.

2.3 GAS VALVES
   A. Manufacturers: Walworth, Homestead, Nordstrom or approved equal.
   B. Two inch (2”) and smaller lubricated plug valves complete with cast iron body, wrench operated and screwed ends suitable for 125 PSI service.
   C. Two and one-half inch (2½”) and larger lubricated plug valves with cast iron body, wrench operated and flanged ends suitable for 125 PSI service.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Properly align piping before installation of valves in an upright position; operators installed below the valves will not be accepted.
   B. Install all temperature control valves.
C. Install valves in strict accordance with valve manufacturer’s installation recommendations. Do not support weight of piping system on valve ends.

D. Prior to flushing of piping systems, place all valves in the full open position.

End Section 23 20 02
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 RELATED WORK
   A. 23 20 01 Pipe and Pipe Fittings

1.3 QUALITY ASSURANCE
   A. Substitution of Materials: Refer to General Conditions of the Contract.

1.4 SHOP DRAWINGS
   A. Include dimensions, capacities, materials of construction, weights, and appropriate identification for all equipment in this Section.

1.5 DESIGN CRITERIA
   A. Constructed in accordance with ASME.

PART 2 - PRODUCTS

2.1 PIPE SUPPORTS ON ROOF
   A. Manufacturers: Dura-Blok or equal.
   B. Furnish rubber support blocks with top channel. Channel to be secured to the tray with through bolts.
   C. Install pipe supports in accordance with manufacturers recommendations.

2.2 EQUIPMENT LABELS
   A. Furnish three-layer plastic laminate equipment labels with engraved letters, 1/16 inch thickness, beveled edges and self-bonding adhesive backing.
      1. Letter Color: Black.
      2. Letter Height: 1/2 inch.
   B. Label all major mechanical equipment, including:
      1. Starters.
      2. Packaged Rooftop Units.
      3. Room Heat Pump Units.
      4. Fans.

2.3 PIPE BANDING
   C. Furnish marking as follows:
      1. Hot water supply.
      2. Hot water return.
      3. Gas piping.
PART 3 - EXECUTION

3.1 EQUIPMENT LABELS
   A. Secure equipment labels directly to equipment in a clearly visible location. For equipment in finished areas, label shall be on inside surface of access panel.

3.2 PIPE BANDING
   A. Install pipe markers every 20 ft. or less with directional flow arrow and proper marking. Application procedure shall be in accordance with manufacturer’s recommendations. Markings shall be securely adhered to pipe or outer insulation jacket. Incomplete or partially attached markers will not be accepted.

End Section 23 20 04
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 RELATED WORK
   A. Section 23 33 07 Ductwork Accessories

1.3 QUALITY ASSURANCE
   A. Substitution of Materials: Refer to General Conditions of the Contract.

1.4 SHOP DRAWINGS:
   A. Include dimensions, capacities, materials of construction, weights, wiring diagrams and appropriate identification for all equipment in this Section.

1.5 REFERENCE STANDARDS
   A. SMACNA
   B. NFPA 90A Standards for the Installation of Air Conditioning and Ventilating Systems.
   C. UL 181

1.6 DESIGN CRITERIA
   A. Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under specified operating conditions.
   B. Use material, weight, thickness, gauge, construction and installation methods as outlined in the following most current SMACNA publications:
      1. HVAC Duct Construction Standards, Metal and Flexible.
      2. HVAC Air Duct Leakage Test Manual.
      3. HVAC Systems - Duct Design.
      5. Round Industrial Duct Construction Standards.
   C. Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

PART 2 - PRODUCTS

2.1 GENERAL
   A. Ductwork shall be minimum G-60 coated galvanized steel of lock forming grade conforming to ASTM Standards A-525 and A-527. Duct wall thicknesses, reinforcements, seams, joints, sealing, cross bracing, beading, hangers, supports, etc., shall be in accordance with the latest manual of heating, ventilating and air conditioning duct construction standards as published by the Sheet Metal and Air Conditioning Contractors National Assoc., Inc. (SMACNA).
   B. All ductwork shall be 2" pressure class.
2.2 LOW AND MEDIUM PRESSURE ROUND AND OVAL DUCTWORK

A. United Sheet Metal Co., Semco Carrier, Linx Industries Lindab Safe, Greater Wisconsin Sheet Metal, Pressure Airduct Corp. Sheet Metal Connectors, or Stamped Fittings, Inc.

B. Round helically wound lock seam zinc coated steel conduit.

C. All fittings shall be minimum 20 gauge zinc coated steel.

D. All 45 deg. elbows shall have a minimum of 3 sections and all 90 deg. elbows shall have a minimum of 5 sections. Smooth long sweep die formed fittings are preferred.

E. Less than 90 deg. angular reducing take-offs shall have the branch occurring in the reducer.

F. Ninety (90) deg. tees shall have long cone take-off for branches.

G. All fittings shall be distortion free.

H. All fittings and joints to be joined using United Duct Sealer or Linx Industries Lindab Safe self-sealing system, in accordance with manufacturers recommendations.

I. All exposed ductwork shall be paint grip galvanized for field painting.

2.3 FLEXIBLE DUCTWORK

A. Furnish and install flexible ducts where indicated on the drawings.

B. Flexmaster, Novaflex, Thermaflex, or Buckley flexible ductwork.

C. Factory applied glass fiber insulation with vaporproof jacket, minimum total insulating value R=6.

D. The ductwork shall be UL 181 listed, Class 1 Air Duct and comply with NFPA 90A and 90B.

E. Supply, Return, and Exhaust Ducts:

1. Flexmaster Type 1, Novaflex Type 8, Thermaflex M-KC, or Buckley Type 3.

2. Polyethylene fabric core supported by a galvanized steel helix formed and mechanically locked to the liner.

3. Working pressure not less than 10” w.g. positive and 2” w.g. negative.

4. Minimum Acoustic Performance:

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<th>Diameter</th>
<th>125 Hz</th>
<th>250 Hz</th>
<th>500 Hz</th>
<th>1000 Hz</th>
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<td>6</td>
<td>27</td>
<td>22</td>
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<td>18</td>
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</tbody>
</table>

F. Transfer Ducts:

1. Flexmaster Type 6M, Novaflex Type 6, Thermaflex M-KE, or Buckley Type 4.

2. Acoustical spun bond nylon fabric core supported by a galvanized steel helix formed and mechanically locked to the liner.

3. Working pressure not less than 6” w.g. positive.

4. Minimum Acoustic Performance:

<table>
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<tr>
<th>Diameter</th>
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<td>31</td>
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</tr>
<tr>
<td>12 inch</td>
<td>22</td>
<td>26</td>
<td>24</td>
<td>31</td>
<td>31</td>
</tr>
</tbody>
</table>
2.4  ACOUSTICAL LINING
   A.  Certainteed, Knauf, Manville or Owens-Corning Aeroflex.
   B.  Supply Ductwork:
      1.  Minimum two inch (2") thick 1.5 pound per cu.ft. density fibrous glass duct liner
           with bacteria and fungi resistant face coating.
      2.  Entire assembly shall provide a minimum R=6.
   C.  Return/Exhaust/Transfer Ductwork:
      1.  Minimum one inch (1") thick 1.5 pound per cu.ft. density fibrous glass duct liner
           with bacteria and fungi resistant face coating.
   D.  Liner shall have a composite flame and smoke hazard rating as tested by NFPA-225 and
        UL-723 not exceeding 25 flame spread or 50 smoke developed.
   E.  Note:  Plan listed duct sizes are the clear inside dimensions.  The sheet metal duct shall
        be increased in each dimension to accommodate the lining.

PART 3 - EXECUTION
3.1  INSTALLATION
   A.  Verify dimensions at the site, making field measurements and drawings necessary for
        fabrication and erection.  Check plans showing work of other trades and consult with
        Engineer in the event of any interference.
   B.  Make allowances for beams, pipes or other obstructions in building construction and for
        work of other contractors.  Transform, divide or offset ducts as required, in accordance
        with SMACNA, except do not reduce duct to less than six inches in any dimension and do
        not exceed a 6:1 aspect ratio.
   C.  Cut or drill test holes in ducts where indicated or as required.  Cap with neoprene plugs.
   D.  Provide frames constructed of angles or channels for coils, filters, dampers or other
        devices installed in duct systems, and make all connections to such equipment, including
        equipment furnished by others.  Secure frames with gaskets and screws or nut, bolts and
        washers.
   E.  Seal all ductwork in accordance with SMACNA requirements for each applicable duct
        pressure class.
   F.  Seal water tight with G.E. Silicone Construction Sealant all joints within 6" of bottom of all
        exhaust ductwork from outside termination back to automatic exhaust dampers and/or
        backdraft dampers.
   G.  Furnish and install a drip pan in exhaust and relief ductwork under each roof exhauster
        and weatherproof hood per plan detail.  Seal water tight with G.E. Silicone Construction
        Sealant all joints in drip pan and all joints within 6" of bottom of drip pan.
   H.  Caulk around all ductwork passing through all walls, ceilings and floors.  For fire rated
        walls use United States Gypsum Thermafiber 4" thick and G.E. Pensil silicone foam
        sealant per plan detail.  For non-rated walls fiberglass insulation may be used in lieu of
        the Thermafiber. For plenum walls, the penetration shall be treated as a one hour fire
        rated wall.
   I.  Install all automatic dampers furnished by the Temperature Control Contractor or
        Subcontractor.  This Contractor shall score the end of the damper rod.  Scoring to be
        parallel with the damper blade.
J. Transverse joints of all pressure classes of ductwork may be made with Ductmate Industries, Inc. or Nexus flanged type joints, or shop fabricated TDC/TDF joints. Joints to be complete with 20 gauge angles with integral mastic sealer, gasket tape, corner pieces, snap-on cleats, etc. Joint shall have zero percent leakage at all pressures up to 10” W.G.

K. Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room or space.

L. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

M. During construction provide temporary closures of taped polyethylene or ductcap covers on open ductwork to prevent construction dust from entering ductwork system.

N. Use double nuts and lock washers on threaded rod supports.

O. The use of wire cable as a duct support is prohibited.

3.2 FLEXIBLE DUCT

A. Flexible duct may be used for final connection to grilles, registers and diffusers as indicated. Where flexible duct is used, it shall be the minimum length required to make the final connections, but no greater than 6 feet in length. Flexible ducts shall be as straight as possible with no more than one 90 deg. elbow.

B. When used in areas containing cloud-type lay-in ceilings, final connection to diffusers shall not exceed 2 feet in length to limit flexible duct visibility.

C. Flexible duct may be used for final connection of supply ductwork and variable volume box inlet ductwork. Where flexible duct is used, it shall be the minimum length required to make the final connections, but no greater than 4 feet in length. Flexible ducts shall be as straight as possible with a maximum offset of 15 deg.

D. Individual sections of flexible ductwork shall be of one piece construction. Splicing of short sections will not be accepted.

E. Penetration of any partition, wall, or floor with flexible duct will not be accepted.

F. Fittings, couplings, etc., shall be joined by applying a coat of 3M EC-800 or Benjamin Foster 30-02 cement to the joining surfaces. Insert fitting to the bead and secure with a metal draw band. Finally, wrap exposed seam with a 3” wide band of pressure sensitive duct tape.

G. Ducts shall be hung from the building construction with galvanized steel strap hangers.

3.3 ACOUSTICAL LINING

A. All lining shall be adhered to the inside of the ductwork on all surfaces with 100% coverage of adhesive at liner contact surface area. In addition, mechanical fasteners with welded pins or fire resistive adhesive attachment clips shall be installed on 12” maximum centers and no further than 4” from the corners. Welded pins shall be installed with a Graham or equivalent capacitor type pin welder.

B. Where dampers, turning vanes or other devices are placed inside of lined ductwork, the installation must not damage the liner or cause erosion of the liner.

C. All exposed leading edges and butt joints shall be buttered with a fire resistant adhesive coating similar to Foster 30-70 to prevent erosion by the air stream.

D. All upstream transverse edges subjected to velocities over 4000 feet per minute shall be fitted with welded or riveted metal nosing.

E. Interior widths of ducts not exceeding 8” do not require mechanical fasteners in addition to adhesive.

End of Section
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 RELATED WORK
   A. 23 31 00 Ductwork

1.3 QUALITY ASSURANCE
   A. Substitution of Materials: Refer to General Conditions of the Contract.

1.4 SHOP DRAWINGS
   A. Include dimensions, capacities, materials of construction, weights, wiring diagrams and appropriate identification for all equipment in this Section.

1.5 REFERENCE STANDARDS
   B. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
   C. UL 214
   D. UL 555 - Standard for Fire Dampers and Ceiling Dampers.

PART 2 - PRODUCTS

2.1 MANUAL VOLUME DAMPERS
   A. Air Balance, Ruskin, Vent Products or approved equal.
   B. Furnish manual volume dampers where indicated and where required to adjust air quantities. Maximum blade length to be 48” and maximum blade width to be 6” with double bend each edge. Each blade up to 18” long shall have 3/8” square pivot rod. Blades 19” to 48” in length shall have ½” square pivot rods for full length of blade.
   Provide, for each damper blade, Ventlock #641 or Young Regulator Co. #403B locking damper regulator and Ventlock #607 or Young Regulator Co. #656 end bearings. When more than one damper blade is required, dampers and quadrants shall be arranged for opposed blade operation. On ducts where are internally lined, provide spacers on the damper shaft to keep the damper blades clear of the lining. Provide waterproof plywood block or Ventfabrics #637 Ventlock elevated locking damper regulator on insulated ductwork.

2.2 AIR TURNING VANES
   A. Barber Colman Co. Airturns or Aero Dyne Corp. H.E.P.
   B. Turning vanes are required on all square or rectangular elbows greater than 45 degrees. Turning vanes are not required at radius elbows having a centerline turning radius of at least 1.5 times the duct width. Elbows with a square throat and radius heel are not acceptable.
   C. Note: Shop made turning vanes will be accepted in lieu of manufactured turning vanes provided the vanes and vane runners are constructed in accordance with SMACNA standards.
2.3 DUCT ACCESS DOORS
A. Air Filter Corp. or Cesco, Inc.
B. Furnish where indicated metal type, gasketed completely removable type with cam locks. Doors to be double walled and insulated where ductwork is lined or insulated.

2.4 DUCT FLEXIBLE CONNECTIONS

2.5 FLEXIBLE DUCT TAKE-OFFS
A. Attachment of flexible ductwork to sheet metal ductwork shall be made by means of high efficiency take-off fittings complete with manual volume damper with locking quadrant and indicating pointers as manufactured by Sheet Metal Connectors or equal.

2.6 WEATHERPROOF LOUVERS
B. Furnish louvers with .081” extruded aluminum alloy blades, frame and supports, horizontal “J” style drainable blades with maximum of 4’-0” unsupported length in a fixed 6” core, 6” minimum blade depth, 3-1/2” blade spacing and 35 deg. blade angle and mullions invisible from exterior face.
C. Furnish louvers with channel type frame for installation in new construction and flange type frame for installation in existing construction with 1/2” mesh .063” aluminum bird screen in extruded U frame mounted behind blades. All screws, bolts, hardware, etc., shall be stainless steel.
D. Units to have a mill finish suitable for field painting.

PART 3 - EXECUTION
3.1 MANUAL VOLUME DAMPERS
A. Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

3.2 AIR TURNING VANES
A. Install all turning vanes tight to the heel of the elbow and “H.E.P.” blades spaced 2-1/2” on center.
B. Maximum unsupported length of turning vane shall not exceed 48”.
C. Where Aero-Dyne Corp. “H.E.P.” vanes are used in ducts 12” and smaller in width, provide a 1-1/2” radius in the throat of the elbow.
D. Turning vanes are not required at radius elbows having a centerline turning radius of at least 1.5 times the duct width. Elbows with a square throat and radius heel are not acceptable.

3.3 ACCESS DOORS
A. Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire and smoke dampers.
B. Heating and cooling coils, filters, valves and control devices needing periodic maintenance.

C. Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as indicated. Install access doors on both inlet and outlet sides of reheat coils as well as other duct mounted coils.

D. Each access door shall be labeled with minimum .5" high letters indicating the device served (i.e. “heating coil”, “automatic damper”, “fire damper”, etc.).

3.4 DUCT FLEXIBLE CONNECTIONS
A. Install at all duct connections to rotating or vibrating equipment, including air handling units, fans, or other motorized equipment in accordance with SMACNA.

B. For applications in corrosive environments or fume exhaust systems, use a double layer of the Teflon coated fabric when making the connector.

3.5 FLEXIBLE DUCT TAKE-OFFS
A. Install at all flexible duct take-offs and in accordance with manufacturers recommendations.

3.6 WEATHERPROOF LOUVERS
A. Connect outside air intake duct to the louver, sealing all connections air and water tight.

B. Install insulated metal panel on unused portion of louver. Panels must be sealed weathertight to louver assembly with flashing as required for proper drainage to outside of building.

End Section 23 33 07
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 RELATED WORK
   A. 23 05 13 Motors and Starters
   B. 23 05 15 Vibration Isolators

1.3 QUALITY ASSURANCE
   A. Substitution of Materials: Refer to General Conditions of the Contract.

1.4 SHOP DRAWINGS
   A. Include dimensions, capacities, materials of construction, weights, wiring diagrams and appropriate identification for all equipment in this Section.

1.5 DESIGN CRITERIA
   A. Test and certify all fans in accordance with the applicable AMCA test code.
   B. Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at scheduled static pressure. The motor furnished with the fan shall not operate into the motor service factor when operating under these conditions.
   C. Where inlet and outlet ductwork or any fan is changed from that shown on the drawings, provide any motor, drive and/or wiring changes required due to increased static pressure or baffling necessary to prevent uneven air flow or improved mixing.

PART 2 - PRODUCTS

2.1 GENERAL
   A. Furnish fans of size, class, type, arrangement and capacity as scheduled on the drawings.
   B. Furnish complete with motors, wheels, drive assemblies, bearings, vibration isolation devices and accessories required for specified performance.
   C. Use OSHA approved belt guards that totally enclose the entire drive. Construct guards of expanded metal to allow for ventilation and provide tachometer openings at shaft locations.
   D. Statically and dynamically balance all fans so they operate without objectionable noise or vibration.
   E. Use AMCA Type A spark resistant construction for all fans handling flammable or grease laden air.
   F. Where required, provide totally enclosed Class 1, Division 1 or Class 1, Division 2 explosion proof motors and spark resistant construction built in accordance with AMCA Type A for fans as indicated. See electrical drawings for exact requirements and area classifications.
   G. Provide all fans controlled by variable frequency drives with shaft grounding rings.

2.2 INLINE FANS
   A. Manufacturers: Acme, Carnes, Cook, Greenheck, Peerless, PennBarry, or Twin City.
B. Furnish fans of steel or aluminum construction with universal type mounting bracket, centrifugal fan wheel with ball bearing supports, NEMA approved ball bearing motor, adjustable V-belt drive or direct connected as indicated, adjustable motor base for V-belt drive units, vibration isolators and bearing lubrication tubes.

C. Furnish integrally wired speed controller for each direct drive unit.

2.3 ROOF EXHAUSTERS

A. Manufacturers: Acme, Carnes, Cook, Greenheck, Jenco Fan, Twin City or PennBarry.

B. Furnish fans with centrifugal fan wheel, NEMA approved ball bearing motor resiliently mounted with integrally wired weatherproof disconnect switch, integral vibration isolators, an aluminum weatherproof fan and motor housing with base to fit over curb and acoustically treated curb. See architectural drawings or visit the site for roof type and pitch.

C. Direct or adjustable V-belt drive as indicated. Adjustable V-belt drive shall be as hereinbefore specified.

D. Furnish integrally wired speed controller with each direct drive unit.

E. Furnish low voltage electric motorized multi-louver backdraft damper as indicated

2.4 DESTRATIFICATION FANS

A. Big Ass Fan Essence, or pre-approved equal.

B. Furnish 8 blade fan, dynamically balanced with totally enclosed fan cooled variable speed motor, U.L. listed, with all necessary hooks, safety cables and supports for a complete installation.

C. Provide 0-10v control for integration with the BAS. On/off, scheduling and speed control shall be controllable through the BAS.

D. Remote control panel wall mounted in location indicated with on/off variable speed control, LCD display and keypad.

E. Powder coated airfoil blades of custom colors as selected by the Architect.

F. Custom hub cover to match blade color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all fans where indicated on the drawings and in accordance with manufacturers recommendations.

B. All suspended fans shall be supported from steel supports with suspensions, frames, brackets, braces, etc. Supports shall be constructed to properly support and distribute the load and shall incorporate anti-vibration devices, anti-sway bracing and anchoring plates as required. Supports may be constructed of I-beams, channels, angle iron or threaded steel rods. All permanent supports shall be welded. All threaded rods and bolts shall have nuts welded to rod, threads peened or double nuts.

C. Roof curb mounted equipment shall be mounted on factory constructed curbs furnished with the fans. Roof curbs shall extend not less than 12” above adjoining roof and shall be sized to accommodate the roof openings and curb flange of the equipment being mounted. The curbs shall be constructed suitable to accommodate anchoring of the equipment being mounted.
D. Destratification fans shall be suspended from the building construction and the blade assemblies shall be balanced after installation to assume stable operation. Safety cables shall be installed to prevent the fan from falling to the floor if the main support fails.

End Section 23 34 00
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 QUALITY ASSURANCE
   A. Substitution of Materials: Refer to General Conditions of the Contract.

1.3 SHOP DRAWINGS
   A. Include dimensions, capacities, materials of constructions, weights, wiring diagrams and
      appropriate identification for all equipment in this Section.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES AND REGISTERS
   A. Manufacturers: Agitair, Anemostat, Carnes, Krueger, Metalaire, Nailor, Price, Reliable,
      Titus or Tuttle and Bailey.
   B. All diffusers, grilles and registers located in lay-in type ceilings and with at least one side
      dimension of 24” shall be furnished with a frame for lay-in installation. See architectural
      room finish schedule for ceiling types.
   C. All grilles and registers located in ceilings shall be furnished with baked enamel finish of
      color selected by the Architect. Selection shall be from manufacturers standard color chart.
   D. All grilles and registers located in doors, walls, floors or soffits shall be furnished with
      baked enamel finish of color as selected by the Architect. Selection shall be made from
      manufacturers standard color chart.
   E. All diffusers, grilles and registers with round duct collars shall be provided with suitable
      adapter plenums. All visible interior surfaces of the adapter plenums shall be painted with
      a flat black finish. All supply adapter plenums shall be insulated to prevent condensation.

2.2 SIDEWALL SUPPLY GRILLES
   A. Furnish grilles with adjustable double deflection steel grille core, flanged frame with
      sponge rubber gasket, horizontal face fins with 3/4” maximum fin spacing and vertical
      rear fins.

2.3 SIDEWALL TRANSFER GRILLES
   A. Furnish grilles with steel grille core, flanged frame with sponge rubber gasket, fixed
      horizontal face fins with a ¾” maximum fin spacing set in an angular position.

2.4 CEILING EXHAUST, RETURN, AND TRANSFER GRILLES (EGG CRATE)
   A. Furnish grilles constructed of aluminum with 1/2 x 1/2 x 1/2 fixed aluminum grid. Grilles
      for T-bar lay-in installation shall have no flange border. Surface mounted type to have
      flange type frame with countersunk holes for surface mounting.

2.5 PLAQUE TYPE CEILING DIFFUSERS
   A. Furnish plaque type ceiling diffusers with a removable 22-gauge steel face panel with the
      exposed surface of the face panel smooth, flat and free of visible fasteners.
   B. Lay-in type frame.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, grilles and registers where indicated on the drawings.

B. For diffusers, grilles and registers located in a lay-in type ceiling, the Mechanical Contractor shall provide all additional ceiling grid tees as required to support or frame the diffuser, grille or register.

C. Coordinate exact and final location of all diffusers, grilles and registers with final lighting and ceiling layout.

End Section 23 37 00
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 RELATED WORK
   A. 23 05 13 Motors and Starters
   B. 23 05 16 V-Belt Drives
   C. 23 09 00 Building Automation System for HVAC
   D. 23 09 93 Control Sequences

1.3 QUALITY ASSURANCE
   A. Substitution of Materials: Refer to General Conditions of the Contract.

1.4 SHOP DRAWINGS
   A. Include dimensions, capacities, materials of construction, weights, wiring diagrams and appropriate identification for all equipment in this Section.

1.5 DESIGN CRITERIA
   A. Electrical components and work must be in accordance with National Electrical Codes and bear the UL label.
   B. Provide all fans controlled by variable frequency drives with shaft grounding rings.

PART 2 - PRODUCTS

2.1 ROOFTOP UNITS
   A. Manufacturers: Aaon, Carrier, Daikin, Trane, or York.
   B. Furnish unit complete with steel casing with minimum 1” thick fiberglass insulation, filter frames with 2” thick pleated throwaway MERV 13 filters, weatherproof finish, all necessary access panels, fully weatherproof for rooftop mounting.
   C. Furnish unit with intake and relief hoods and a factory fabricated insulated roof mounting curb as hereinbefore specified.
   D. Furnish unit with powered exhaust relief.
   E. Hot gas dehumidification coil for units indicated. See 23 09 93 for control sequences.
   F. Unit to be completely factory prewired, and shall include a control transformer, magnetic contactors and weatherproof disconnect switch.
   G. The fan section shall include a forward curved centrifugal or plenum-type supply fan with sleeve bearing supports, a NEMA approved motor with built-in overloads. Unit fan to be direct connected or have an adjustable v-belt drive as indicated.
   H. Provide a variable frequency drive as hereinbefore specified for the supply fan.
   I. The cooling section shall have direct expansion cooling coils constructed of copper tubes and aluminum fins and a drain pan.
   J. The compressor condensing section shall have copper tube and aluminum fin or aluminum microchannel condensing coils, hail guards, direct connected propeller fans and totally enclosed motors, vertical air discharge with fan guards. Compressors shall be direct drive scroll type. Provide unit with a modulating scroll compressor or a minimum of
3 stage capacity control. Furnish oil pump for positive lubrication, gas cooled motor, crankcase heaters, internal temperature and current sensitive motor overloads and low pressure switches, magnetic contactors, automatic pumpdown control and time delay relays, a full charge of compressor oil and refrigerant and a 5 year compressor warranty.

K. Each refrigerant circuit shall have independent fixed orifice expansion devices, service pressure ports and refrigerant line filter driers.

L. Provide 120 volt convenience outlet.

M. Gas heating section shall have a stainless steel heat exchanger and stainless steel burner for natural gas operation. Capacity control staging shall be as scheduled. Also furnish an adjustable gas pressure regulator suitable for the gas inlet pressure indicated, electric ignition, manual main gas shut-off valve, heat exchanger high temperature limit control and the entire unit shall be AGA approved. Provide minimum 5 year heat exchanger and burner warranty.

N. Control:

1. Unit shall be factory pre-wired to a terminal strip for installation of field mounted controls by the BAS Contractor. See 23 09 93 Control Sequences for complete control sequence requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Units shall be mounted on a weathertight factory fabricated roof curb where indicated on the drawings and in accordance with the unit manufacturers recommendations. See Architectural plans or visit the site for roof deck type, pitch and insulation thickness.

B. Provide loop seal per detail at each cooling coil drain pan connection.

C. Provide full factory start-up services and warranty effective from the date of start-up.

D. All field wiring shall be done by the BAS Contractor except power wiring to the unit.

End Section 23 74 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 work of this Section.

1.2 RELATED WORK
A. 23 05 13 Motors and Starters.

1.3 QUALITY ASSURANCE
A. Substitution of Materials: Refer to General Conditions of the Contract.

1.4 SHOP DRAWINGS
A. Include dimensions, capacities, materials of construction, weights, wiring diagrams and appropriate identification for all equipment in this Section.

1.5 DESIGN CRITERIA
A. Forced Circulation Coils: Ratings certified in accordance with ARI 410.
B. Electrical components and work must be in accordance with National Electrical Codes.

PART 2 - PRODUCTS

2.1 GENERAL
A. Furnish types, arrangement and capacities as scheduled.

2.2 CONVECTORS
A. Manufacturers: Airtherm, Embassy, Modine, Rittling, Rosemex, Sigma, Sterling, Vulcan or approved equal.
B. Construct heating elements of copper tubes with aluminum fins expanded into cast iron or brass headers. Support heating elements on adjustable brackets to allow for expansion and pitch.
C. Furnish the following types as indicated on plan schedule:
   1. Type RGB: Fully recessed, front inlet and outlet grilles, four-sided recess flange, 16 gauge front and 20 gauge enclosure.
D. Furnish end pockets and manual air vent assemblies as indicated.
E. Cabinets to have a baked enamel finish of manufacturers standard color as selected by Architect.

2.3 CABINET HEATERS
A. Manufacturers: Airtherm, Embassy, Daikin Applied, Modine, Rittling, Rosemex, Sigma, Sterling, Trane or Vulcan.
B. Construct heating elements of copper tubes with aluminum fins expanded into cast iron or brass headers. Coils to be hot water or steam type as indicated.
C. Furnish cabinets of 16 gauge steel with forward curved centrifugal fan resiliently mounted motor of speed indicated, direct or adjustable v-belt drive, manual starter or built-in motor overload protection and disconnect switch, three speed and on-off switch. Switches to be prewired and integrally mounted in cabinet with access door on floor mounted units. Switches to be shipped loose for ceiling mounted units for field installation by the Mechanical Contractor.
D. Furnish manual air vent where indicated.
E. Furnish the following types as indicated on plan schedule:
   1. Type IW: Wall mounted with top front inlet grille and bottom front outlet grille.
   2. Type ISGB: Inverted semi-recessed with top front inlet and bottom front outlet grilles and 4-side recess flange.
   3. Type C: ceiling mounted with bottom inlet grille and front outlet grille.
   4. Type CR: Ceiling mounted with bottom inlet and outlet grilles and 4-side recess flange.
F. Cabinets to have a baked enamel finish of manufacturers standard color as selected by Architect.

2.4 FAN COIL UNITS
A. Manufacturers: Airtherm, Embassy, Carrier, IEC, Johnson Control, Daikin Applied, Rittling or Trane.
B. Furnish unit with forward curved centrifugal fan with direct connected three-speed sleeve bearing motor split capacitor type with built-in overload protection, with three speed-off controller internally wired and integrally mounted with access door on floor mounted units and remote flush mounted on ceiling type units. Throwaway filters.
C. Furnish copper tube, aluminum fin hot water coil as indicated.
D. Cabinet to be 18 gauge insulated steel casing with baked enamel finish of manufacturers standard color as selected by Architect and type as follows:
   1. Type HC: Horizontal concealed with front outlet duct collar and rear inlet collar.

2.5 ROOM HEAT PUMP UNITS
A. Manufacturers: Carrier, Mitsubishi, or pre-approved equal.
B. Furnish a unit with a galvanized steel cabinet with a baked enamel finish, with a wall mounted evaporator section, front discharge grille, and cleanable filter.
C. Motor to be multi-speed as indicated with speed switch prewired in cabinet.
D. Exterior remote mounted heat pump unit with air cooled condenser and hermetic compressor and pre-insulated refrigerant lineset from evaporator to heat pump unit.
E. Low outdoor ambient control to allow heat pump operation of 80% heating capacity at -20 degree F outdoor temperature.
F. Remote mounted, wired, 7-day programmable low voltage room thermostat with auto-on-off selector switch.

PART 3 - EXECUTION
3.1 INSTALLATION - GENERAL
A. Install units in accordance with manufacturers installation instructions.
B. Install branch water or steam/condensate piping to each unit with a minimum of three elbows to allow for expansion and contraction of the piping.
C. Coordinate location of units with other trades to assure correct recess size for recessed units.
D. After installation, provide protective covers to prevent accumulation of dirt on unit during balance of construction.
3.2 CONVECTORS
A. Mount units in locations indicated on the drawings and as detailed.
B. Verify that any unit installed in a fire rated wall will not destroy the integrity of the rating.

3.3 CABINET HEATERS
A. Mount units in locations indicated on the drawings and as detailed.
B. Verify that any unit installed in a fire rated wall will not destroy the integrity of the rating.
C. Install speed control and on-off switches shipped loose for all ceiling mounted units above ceiling near unit.

3.4 FAN COIL UNITS
A. Coordinate exact location and size of louver for units with wall intake louvers with other trades.

3.5 ROOM HEAT PUMPS
A. Mount units in locations indicated on the drawings.
B. Remote mounted condensing unit and/or heat pump to be grade, wall or roof mounted as indicated. Units on grade to be mounted on precast concrete pads 3” larger than base of the unit and 4” thick.
C. Wall mounted units to be supported with steel wall support brackets furnished, installed and painted by the Mechanical Contractor. Roof mounted units to be mounted on support blocks as hereinbefore specified and Type “W” vibration pads.

End Section 23 82 01
SECTION 26 05 00
ELECTRICAL CONTRACT REQUIREMENTS

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work under this Section.

APPLICABLE PUBLICATIONS
Publications, standards and listing requirements called out in the Sections of this Division of Labor shall form a part of these specifications as if contained herein.

The requirements of the Contract Documents, including the General Conditions, and Supplementary Conditions, and Division 1 - General Requirements, apply to this section except as modified herein.

DESCRIPTION OF WORK
Sections Included:

Section 26 05 00 - ELECTRICAL CONTRACT REQUIREMENTS
Section 26 05 02 - ELECTRICAL DEMOLITION
Section 26 05 04 - DOCUMENTATION
Section 26 05 05 - THROUGH PENETRATION FIRESTOPPING
Section 26 05 19 - WIRE AND CABLE
Section 26 05 26 - GROUNDING
Section 26 05 29 - SUPPORTING DEVICES
Section 26 05 34 - RACEWAYS
Section 26 05 35 - ELECTRICAL BOXES
Section 26 05 37 - LOCATION OF OUTLETS AND EQUIPMENT
Section 26 05 53 - ELECTRICAL IDENTIFICATION
Section 26 09 23 - LIGHTING CONTROLS
Section 26 22 00 - TRANSFORMERS
Section 26 24 16 - PANELBOARDS
Section 26 27 02 - MOTOR WIRING
Section 26 27 26 - WIRING DEVICES
Section 26 27 28 - CIRCUIT AND MOTOR DISCONNECTS
Section 26 51 13 - INTERIOR LIGHTING FIXTURES
Section 27 30 00 - TWO-WAY COMMUNICATION SYSTEM
Section 27 10 00 - STRUCTURED CABLING SYSTEM
Section 27 51 25 - INTERCOMMUNICATIONS SYSTEM
Section 28 31 00 - ADDRESSABLE FIRE ALARM SYSTEM

Work Included:
The work covered by this Division of the specifications includes the furnishing of all labor, materials, tools, equipment, permits, certificates and temporary protection necessary for or incidental to executing and completing the electrical work, communications work, and work on related systems.

All work shall be as specified and indicated on the drawings unless specifically excepted on the drawings or herein.

Read all other Divisions of the Specifications which are applicable to this work, including the General Conditions section applicable to all bidders.

The Electrical Contract Requirements section is a supplement to and not a replacement for the project General Conditions section.
In cases of conflict with information in the General Conditions, the more stringent of the contract requirements shall be considered applicable.

Prior to submitting bid, call to the attention of the Electrical Engineer any material or apparatus believed to be inadequate or any necessary items or work omitted.

Address any questions regarding the interpretation of the plans and/or specifications at least 12 days before the bid opening.

The Electrical Engineer reserves the right to interpret his own specifications and plans after bids are received, and to demand that the installation conform to his intent.

Failure to become acquainted with existing conditions at the site shall in no way relieve the responsibility for making installation in conformance with plans and specifications without additional cost to the owner.

Examination of Plans, Specifications and Site:
Before submitting a bid, the bidder shall familiarize himself with all features of the building and site which may affect the execution of his work.

No extra payment will be allowed for the failure to obtain this information.

If there are omissions or errors in the plans or specifications, they shall be clarified with the architect prior to submitting bid.

For all remodeling projects, a site visit to the premises, for the purpose of the noting of all existing conditions which may affect work is required.

Knowledge of all existing conditions, which may affect work in a renovation project, shall be included in the preparation of bid.

Lack of information on existing conditions shall not be allowed for a valid cause for additional compensation.

Codes, Permits, and Inspection Fees:
All work and materials shall conform in every respect to the current rules and requirements of the National Fire Protection Association, National and State Electrical Codes, Local Codes and Ordinances, Local Utility Regulations and OSHA.

Give to the proper authorities all required notices relating to the project, obtain all official permits and licenses required, pay all fees incidental thereto, deliver upon completion of the work and without cost to the Owner all required certificates of inspection and approval.

RELATED WORK ELSEWHERE
Applicable provisions of Division 1: General Conditions shall govern work in this section.

All other Divisions of the Specifications which are applicable to or interface with work in Division 26 05 00.

Division 26 contractor to include all costs for Division 27 and 28 in his bid.

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.
Submit shop drawings following Section specific Shop drawing submittal guidelines.
OPERATION & MAINTENANCE MANUALS
Submit operation and maintenance manuals in accordance with Section 26 05 04.
Submit operation and maintenance manuals following Section specific shop drawing submittal guidelines.

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.
All materials, equipment and parts are to be new, undamaged and unused of current manufacture.
Acknowledge acquaintance with the plans and specifications and their respective requirements.
Guarantee that the electrical system has been installed strictly in accordance with the electrical plans and specifications using only the best of materials available, installed in a substantial manner by experienced labor.
Replace and/or repair any items failing from causes of faulty workmanship, materials or design without cost to Owner at any time within one year from date of final acceptance.

WARRANTY
Equipment shall be warranted for a period of not less than 2 years from the date of commissioning against defects in material and workmanship.
The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

PART 2 - PRODUCTS
GENERAL
It is the intent of these specifications that all the necessary material, apparatus, and devices to complete the installation as specified herein, except such parts as are specifically excepted, shall be provided.
If an item is either shown on the plan or called for in these specifications, it shall be considered sufficient of said item in this contract.
All sizes given are as minimum.
Material and labor shall be first class and workmanlike and to the satisfaction of the Electrical Engineer and shall be subject to inspection test and approval at all times from commencement until acceptance of completed work.
Manufacturers shall be responsible for providing material listed by U.L. or other approved agencies, and all governing codes and ordinances.
All material must bear U.L. and/or other approved labels where possible.
Items specified by catalog number or brand name and approval of shop drawings will not relieve the manufacturer of this responsibility.
MATERIALS: ALTERNATE MATERIALS
Where materials, equipment apparatus, or other products are specified by manufacturer, brand name, and type of catalog number such designation is to establish standards of desired quality and style and shall be the basis of the bid.
Substitutions shall not be made unless there are "equals" listed in the specifications or on the plan.
Substitutions may be bid as alternates.

Burden of proof that materials are equal shall be upon bidder requesting their use; therefore, bidder shall furnish, with their request for approval all supporting data.

Assume responsibility for substituted material and state name of manufacturer, type or brand or equipment and addition to or deduction from base bid.

Materials and equipment must meet all requirements as to type, quality, function, appearance and physical dimensions shown.

Assume responsibility for any costs to other Divisions as a result of the use of alternate materials.

Submit supporting data to Architect/Electrical Engineer within 15 days after the bid date.

PART 3 - EXECUTION

EXAMINATION
Equipment Submittal Drawings:
Within 45 days after a notice to proceed and prior to ordering equipment, furnish to the Electrical Engineer submittal drawings for review (see section 26 05 04).

Review of any submittal drawings does not waive any condition of the specifications unless specifically noted thereon.

No fabrication or ordering of equipment shall be started until reviewed drawings are returned.

FIELD MEASUREMENTS
Job Drawings:
Maintain, at the job site, one (1) complete set of up-to-date plans and written specifications, complete with all addenda items.

This complete plan and specification set shall be reserved for all field markings to show minor revisions and detailed construction notes.

These marked plans shall be returned to the Electrical Engineer prior to contract completion and final payment.

Assist the Electrical Engineer in transferring applicable field notes to the project drawings for record purposes.

DELIVERY, STORAGE AND HANDLING
Material on Site and Storage:
Maintain proper care and storage of material and equipment on site.

Any material damaged by rust corrosion, warping, breakage, finish damage, etc. shall be replaced by the Contractor to the satisfaction of the Engineer.

INSTALLATION
Field Change Orders:
No revisions to the contract price shall be allowed unless such revisions have been authorized in writing by both Owner and the change order submitter.
All work completed prior to completion of a written contract change order will not be compensated for by the Owner.

Any work item that is proposed to perform, on the basis of a proposed contract adder, must be announced in advance such that time is available for the Architect, Owner and the Electrical Engineer to determine if a change in contract price is allowable.

Change Orders:

Change orders may be requested as a part of this project.

Assume the following in regards to change orders:
  Work and equipment associated with change orders shall be installed per the specified equipment on this project.

All change orders shall be accounted for on as-built drawings.

Change order additions to special systems where riser diagrams have been furnished, shall be included as a part of the riser diagram.

A breakdown of all costs associated with the change order is required.

The cost breakdown shall be as follows:
  Itemized list of all materials.

  Materials shall be priced at Best Column in a national pricing service book.

  Cost for subcontractor services.

  Subcontractor services shall be shown as actual costs from subcontractor.

  Material mark-up.

  Maximum allowed is 8%.

  Number of hours of labor at standard charge out rate.

  Tax on material.

  Total change order cost.

If equipment or materials are deducted as a part of this change order, credit shall also be shown on change order.

Installation: General

Connections to Equipment Furnished By Others.
  Included in Division 26 are electrical connections to equipment provided by others.

  Refer to final shop drawings for equipment provided by other divisions for exact location of electrical outlets and the connections required.

  Provide energization to the equipment furnished by other Divisions only at the request of the providing party.
Assume that once the equipment has been started up, that it shall be shut off unless it is requested that it be left on by the providing party.

Only start up and turn on equipment if requested so by the party providing said equipment.

If required, power shall not be activated to the equipment until qualified starting personnel are on site.

After making a permanent power connection, the breaker shall be left in an off position and a "hold" tag or some other device be utilized to keep the power turned off to the equipment.

Equipment Access & Location.

All equipment, junction and pull boxes, and accessories shall be installed to permit access to equipment for maintenance.

Any relocation of conduits, equipment, or accessories required to provide maintenance access shall be accomplished at no additional cost.

Equipment shall be installed with ample space allowed for removal, repair or changes to the equipment.

Ready accessibility to equipment and wiring shall be provided without moving other equipment which is to be installed or which is already in place.

Locate electrical outlets and equipment to fit the details, panels, decorating or finish at the space.

The Architect shall reserve the right to make minor position changes up to 10' of the outlets before the work has been installed.

Verify door swings before installing room lighting switch boxes, and install boxes on the latch side of door unless noted otherwise.

Furnish information as to exact location and size of sleeves for openings for new construction.

Provide and set in place all required sleeves, inserts, forms, etc. and coordinate this work with all other divisions of work.

Cutting and patching.

Beams or columns shall not be pierced without permission of the Architect and then only as directed.

If any openings are required through walls or floors where no sleeve has been provided, the hole for the sleeve shall be core drilled to avoid all unnecessary damage and structural weakening.

Provide all cutting and patching required for complete installation of systems unless specifically noted elsewhere.

All new or existing work cut or damaged shall be patched and restored to its original condition.

Coordinate the location of sleeves, openings, chases, furred spaces, etc.

Provide during the progress of construction all sleeves, hangers and inserts that are to be built into the structure.
Provide sleeves for cables passing through masonry, concrete or other similar construction.

Sleeves shall be of metal conduit and shall extend completely through the construction.

Conduits or cables penetrating smoke or fire barriers must not destroy the barrier's integrity.

Grout openings between sleeves and concrete or masonry walls and floors.

Pack annular space between sleeves and conduits with fiberglass.

Where penetrations occur through fire rated walls or floors, fill space with fire resistive caulk.

Where cables must pass through fire or smoke rated walls or floors, provide approved, sleeved, foam filled fire stops around cables as manufactured by O.Z., Dow, Square D, or equal.

Provide all materials required for patching unless otherwise noted.

Where alterations disturb lawns, paving, walks, etc., the surfaces shall be repaired, refinished and left in the condition existing prior to commencement of work.

Excavation and backfill.
Lines passing under foundation walls shall have a minimum of 1 1/2 inch clearance.
Care shall be taken to insure no disturbance of bearing soil under foundations.

Attachments and supports.
Be responsible for proper fittings and support for each item of equipment and materials installed under Division 26.

Be responsible for the proper application, installation and location of all necessary and required inserts, supports and anchor bolts.

Where same are to be installed by other Divisions of work, supply same to the contractor in whose work they occur with instructions for placement and proper installation.

Establish the method and nature and select accessories necessary for proper support appropriate to item and point of attachment with due consideration given to ambient/environmental conditions and service duty.

Attachments, supporting devices and accessories shall be specifically designed for the application, suitable for the duty imposed in service and acceptable to the Architect.

Attachments shall be made to structural components of the structure in such manner not to jeopardize the integrity of the structure and otherwise consistent with trade practices.

Generally, anchors shall be concrete insert type in poured concrete and drilled expansion type in precast concrete.

Powder actuated anchors shall not be used in concrete work.

Provide all mounting backboards as required to mount electrical and electronic equipment.

That equipment which is normally assumed to be mounted on some type of a backboard shall be mounted on backboards provided by Division 26.
All mounting backboards used by the contractor shall be 3/4" AC grade marine duty plywood.

All plywood shall be painted on both sides and edges with two coats of fire resistant gray enamel paint.

Provide back mounting panels to meet this specification.

Steel channel interior to be painted or galvanized.

Exterior conduit mounting channel shall be stainless steel.

All sleeves to be furnished and installed by Division 26.

Installation: Temporary Electric Distribution

All power consumption costs will be paid for by others

All single phase receptacle outlet circuits shall have approved ground fault circuit interrupter protection or other OSHA approved protection systems.

Installation: Trial Usage of Electrical Systems

The Electrical Engineer has the privilege of the trial usage of electrical systems or parts thereof for the purpose of testing under load the new installation and learning the operational procedures.

The trial usage shall be continued for a length of time as deemed reasonable by the Electrical Engineer and all related costs shall be included in the bid, with the exception of the electrical power cost which will be paid by the Owner.

The operations shall be carried out only with the express knowledge and under supervision of the responsible sub-trade who shall not waive any responsibility because of trial usage.

While trial usage will be kept to a minimum, it shall not be construed as acceptance by the Electrical Engineer.

Installation: Cooperation/Coordination

Coordinate and cooperate with other Divisions of work and Owner by scheduling and installing work to facilitate the construction progresses and the Owners use of the building.

Any deviation from contract plans shall be approved by the Electrical Engineer before proceeding.

Study the plans of other trade divisions of work and to fit work into the work of others in a coordinated manner.

Lay out work and be responsible for measurements.

Check facilities provided by others which require electrical connections and provide outlets suitably located for them.

Take such measurements as may be necessary to assure approved fitting and proper installation of his work and all other work depending thereon.

Cooperate with other contractors to avoid complications between the installation of electrical equipment and equipment installed by others.
Installation: Finish and Painting

Equipment and materials such as transformers, panels and switches, shall be furnished with the manufacturer's standard finishes, consisting of a prime coat and baked enamel finish coat, unless otherwise noted.

Roof mounted equipment and other exterior materials including support hardware shall have a factory or field applied prime coat and finish coat of color selected by the Owner's Representative.

In general painting will be done by other trades. Assume responsibility to coordinate work with the painters so that all equipment is installed prior to painting.

Assume responsibility for additional expense required to paint support channels, panel trims, flush junction box covers, fixture hangers and other electrical devices not in place prior to normal routine painting.

An undamaged finish is required on all equipment.

If finish becomes rusted, corroded, scratched, or flaked during storage or installation, be responsible for refinishing the equipment to the satisfaction of the Architect.

Finish painting on the job site is not required by the electrical contractor, except where noted.

Refer to other areas of this Division 26 for painting of equipment furnished by the Division 26.

Where painting is required to be done by the electrical contractor, the painting shall be done in accordance with the painting portion of the general specification.

Installation: Damage to Other Work

Assume responsibility for all damages resulting from the execution of work under Section 26 05 00.

Assume responsibility to adequately protect Division 26 work at all times.

All damages resulting from their operations shall be repaired, or the damaged portions replaced by the party originally performing the work (to the entire satisfaction of the Architect), and all cost thereof shall be borne by those responsible for the damage.

Installation: Clean-Up

At all times, keep the premises free from excessive accumulation of waste materials or rubbish resulting from work, including tools, scaffolding, and surplus materials and leave work room or it's equivalent, clean.

In case of dispute, the Architect may order the removal of such rubbish and charge the cost to the responsible Division of work as determined by the Architect.

At the time of final clean-up, all fixtures and equipment shall be thoroughly cleaned and left in proper conditions for their intended use.

Installation: Drawing Schedules and Details

The electrical drawings include a number of standard and job specific details.

These details may or may not be specifically referenced on the drawings and in the specification.

Assume that even if the detail is not specifically referenced, that it shall apply to this project. (As an example, if a detail is shown for the exterior mounted receptacles, but the detail is not referenced from the plan sheets, the contractor shall assume that all exterior mounted receptacles shall be installed per the detail.)
Details and schedules are shown as a means to aid the electrical contractor and are not meant to be all inclusive of all devices.

Assume responsibility for making takeoff of equipment required, (i.e., additional circuit breakers, motor connections, etc.) and ancillary equipment and appurtenances for a complete connection or circuit.

Verify all sizes of electrical equipment with shop drawings and nameplate rating of the equipment it serves.

Installation: Coordination Drawings
Prepare coordination drawings to a scale of ¼” = 1’0 or larger; detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components.

Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the work, including, (but not limited to) the following:

- Indicate the proposed locations of major raceway systems, equipment, and materials. Include the following:
  - Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
  - Exterior wall and foundation penetrations.
  - Fire-rated wall and floor penetrations.
  - Equipment connections and support details.
  - Sizes and location of required concrete pads and bases.

Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

Locations include, but are not limited to, electrical rooms and other specialty electrical and communication rooms where equipment is being provided.

Installation: Bid Drawings
It must be understood that electrical drawings and details bid drawings are diagrammatic.

Electrical drawings and details bid drawings are not intended to be shop drawings.

It is expected that it may be necessary to move conduit, outlets and/or equipment in some cases to get coordinated installation and such changes are considered a part of the Contract obligation without cost to the Owner.

No outlets or equipment shall be located where the usefulness and/or operation will be affected by the work of other trades, door swing, counter, equipment, etc.

Installation: Contract Termination Requirements
Furnish Owner with service manuals for all items furnished under this Contract.

Service manuals shall be complete with drawings, diagrams, operations and installation instructions and parts lists.
OWNER TRAINING
Provide as outlined per section.

SPARE EQUIPMENT
Provide as outlined per section.

* * * * *
SECTION 26 05 02
ELECTRICAL DEMOLITION

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work of this section.

PART 2 - PRODUCTS

MATERIALS AND EQUIPMENT
Materials and equipment for patching and extending work: As specified in individual Sections.

RELABELING OF EXISTING PANELS
Where there are existing panels in place, provide new panel directories and verify existing loads served.

PART 3 - EXECUTION

EXAMINATION
Verify field measurements and circuiting arrangements are as shown on Drawings.

Verify that abandoned wiring and equipment serve only abandoned facilities.

Beginning of demolition means electrical & communication contractor accepts existing conditions.

PREPARATION
Disconnect electrical & communication systems in underground excavated walls, floors, and ceilings scheduled for removal.

Coordinate utility service outages with Utility Company if required.

Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations.

CONNECTIONS TO EXISTING EQUIPMENT
On remodeling projects there are various references made on the electrical & communication contract drawings which indicate connections to existing equipment and distribution panelboards. Visit the job site prior to assembling bid to investigate how to make connections to existing equipment. In many cases the plans do not specifically delineate how these connections are to be made.

Connections to existing panelboards shall be thoroughly investigated by the ELECTRICAL CONTRACTOR.

DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK
Work with the general contractor and all other contractors to provide all electrical work as required to disconnect all electrical connections in the demolished area.

Remove, relocate, and extend existing installations to accommodate new construction.

Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

Disconnect and remove abandoned panelboards and distribution equipment. Extend existing circuits as required to new panelboard or other panelboards with space.
Repair adjacent construction and finishes damaged during demolition and extension work.

Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

Check with Owner to determine if the Owner wants to retain the removed equipment. If so, move it to the Owner’s storage, assumed not to be in the same building, but within 5 miles of site. If not, remove material and dispose of properly at own expense.

Re strap existing conduit that will remain or be reused to comply with code above existing lay-in ceilings where work is preformed.

EXISTING CEILING WORK
In areas where existing ceilings are installed and must be removed and reinstalled to facilitate the installation of electrical equipment, assume responsibility for removal and reinstallation of ceiling tiles. Replace ceiling panels and tiles that are broken during this removal and reinstallation. The only time that the contractor shall be relieved of this responsibility is if it is so stated on the drawings.

EXISTING IN-GROUND UTILITIES
Mark all in-ground electrical and communication utilities in areas of excavation. Determine, with other contractors, where excavations will take place, and work with the Owner and existing drawings to mark existing in-ground utilities. Instruct all other trades as to the location and depth of the utilities. This shall include:
- Electrical & communication power and lighting circuits.
- CATV
- Telephone
- Data
- Security
- Monitoring cable

RECONNECTION TO EXISTING CIRCUITS
Where it is indicated on the drawings as ‘reconnect to existing circuit’ assume that the note references reusing the panelboard circuit. Determine if the existing raceways and conductors are in place for that connection. Extend the circuit from the new equipment back to the point where conduit and wire are available. Coordinate with the demolition contractor to maintain conduits and conductors that the electrical contractor may require to remain in place for reuse. Provide new raceway supports, conduit extensions, and circuit extensions as required.

Where it is indicated to refeed the circuit from a new panel, assume that the note references using a new circuit breaker in a new panel and allow for the additional wire to the first point of connection after the breaker to be new. From that point, the existing wiring is to be reused unless the contractor determines it is faulty, in which case, the contractor is to replace it so as to leave the installation safe.

CLEANING AND REPAIR
Clean and repair existing materials and equipment which remain or are to be reused.

Panelboards: Clean exposed surfaces and check tightness of electrical connections on any panelboards that are to remain. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
REMOVAL NOTES ON DRAWINGS

Disconnect, remove, and close openings of all electrical equipment that serve functions in existing rooms when those rooms change function.

* * * * * *
SECTION 26 05 04
DOCUMENTATION

PART 1 - GENERAL

RELATED DOCUMENTS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work of this section.

SYSTEM PRE-INSTALLATION INFORMATION
Provide system pre-installation information for all equipment indicated on the Project Documentation Submittal List. Information shall include:

System wiring diagrams:
System wiring diagrams for the systems listed below shall be provided as a complete riser diagram. This riser diagram shall include all components of the system, as well as a designation adjacent to each component indicating the room or space in which it is located. Cable type used shall also be identified. This designation shall be by description of space or by room number.
Spec section 27 10 00 – structured cabling system.

Diagram format:
All riser diagrams shall be done in the following manner:
CAD drawings.

All symbols used shall be the same symbols are used on the electrical contract documents.

Each component of the built-up system must have the following information provided:
Each component must be indicated on a riser diagram and shown how it interconnects to other parts of the system.

Provide front elevation of rack or enclosure for system.

Size of enclosure shall be indicated.

Spacing or special mounting requirements shall be indicated.

System installation information shall be updated to reflect the installed system. This updated information shall be included as a part of the final O&M manual.

Drawings shall be supplied for each existing building system that is revised or added to. The drawings do not have to show all existing building equipment, only those items where the new system is extended from. A brief description should be given of the existing system and how it was extended.

Record drawings shall be reduced to 11" X 17" or 8 1/2" x 11" and included with the equipment drawings in the final O&M manual. See O&M MANUAL Description in this specification section.

FINAL TESTS AND DEMONSTRATIONS
Test all work and all equipment installed to ensure its proper and safe operation. Check all interlocking and automatic control sequences, and test the operation of all safety and protective devices. Rectify all defects. Coordinate this work with the Power Company, supplier's representative and all other persons as directed by the OWNER or his representatives, in order to achieve the proper and intended operation of all equipment.
Test, adjust and record operating voltages at each system level before energizing branch circuits. Transformer taps must be adjusted to obtain as near as possible nominal system voltage. Where transformer is under Utility jurisdiction, obtain services of Utility to correct voltage. Be responsible for replacement of all devices and equipment damaged due to failure to comply with this requirement.

Balance load among feeder conductors at each panelboard, and reconnect loads as may be necessary to obtain a reasonable balance of load on each phase. Electrical unbalance shall not exceed 10%.

Provide all instruments and equipment necessary to perform required tests.

All checks and tests shall be permanently recorded and made available to the OWNER or his representatives. The tests shall include:

- System grounding
- Fuses:
  - Equipment nameplate requirement
  - Actual fuse rating
- Breakers:
  - Nameplate
  - Actual rating
- Motors:
  - Complete nameplate data
  - Overload relay element
  - Voltage and current phase readings
  - Direction of rotation
  - Ampere readings on any cable operating in parallel to insure an even division of current.

The above reading shall be made for all fuses, breakers, motors and parallel cables installed as part of this contract and connected to by Division 26. This testing shall be for all new equipment, whether furnished by the electrical contractor or not.

Upon request, demonstrate proper operation of all electrical systems and equipment in the presence of the Architect’s Consulting Electrical Engineer and/or other designated persons.

**PROJECT CLOSEOUT CHECKLIST**

Submit the following:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SUPPLIED TO:</th>
<th>CHECK OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting of all cash allowances</td>
<td>ENGINEER</td>
<td></td>
</tr>
<tr>
<td>as detailed in spec section 26 05 01.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submit invoices from utilities.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Letter stating all specified spare</td>
<td>ENGINEER</td>
<td></td>
</tr>
<tr>
<td>equipment was delivered to owner. The</td>
<td></td>
<td></td>
</tr>
<tr>
<td>letter should list the equipment supplied.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O&amp;M Manual</td>
<td>ENGINEER</td>
<td></td>
</tr>
<tr>
<td>Certificate from systems</td>
<td>ENGINEER</td>
<td></td>
</tr>
<tr>
<td>suppliers stating that the system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>was started up, tested</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and owner's instructions were given.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificate shall have</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
date of instructions and test
and shall have the owner's
representative's signature.

Copy of marked up record drawing. ENGINEER _____

Provide warranty for all ENGINEER _____
equipment.

*** ***
SECTION 26 05 05
THROUGH-PENETRATION FIRESTOPPING

PART 1 - GENERAL

DESCRIPTION OF WORK
Contractor (EC, MC, PC or FPC) shall reference specification Division 07 for all firestopping materials and
requirements.
All penetrations through fire and/or smoke rated walls required by this contractor shall be utilizing sleeves or
openings dedicated to the contractor’s systems. This contractor shall coordinate with the Firestopping Contractor to
ensure that the sleeve, conduit, or opening fill is not exceeded for the planned firestopping system. Do not share
sleeves, openings, or penetrations that require firestopping with other trades.
All firestop materials shall be furnished and installed by a dedicated Firestopping Contractor, costs for which shall
not be born by this contractor.
The intent is that this contractor shall identify and coordinate all penetrations through fire barriers with the
Firestopping Contract.
The contractor (EC, MC, PC or FPC) shall indicate what type of material, system, or product will penetrate each
fire/smoke rated assembly to ensure that there is a UL Listed firestop assembly that will restore the listed fire/smoke
erating to the element being penetrated.

* * * * * *
SECTION 26 05 19
WIRE AND CABLE

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1
specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and
Standards, current edition:
   NFPA 70 – National Electrical Code.
   ANSI/TIA/EIA-568-B.2.
National Electrical Contractors Association (NECA), Standard of Installation, current edition.
National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
Underwriters Laboratories, Inc. (UL).

DESCRIPTION OF WORK
Furnish and install a complete and operable wire and cable system as indicated on the drawings and as specified
herein.

RELATED WORK ELSEWHERE
Division 26: Electrical

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.

OPERATION & MAINTENANCE MANUALS
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

The following information shall be submitted in addition to the items listed above:
   Manufacturer literature in scope to demonstrate compliance with the requirements of this specification.
   Clearly identify the types of wire and cable proposed.

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.

Wire and cable manufacturers shall be certified to ISO 9001 International Quality Standard and shall have third
party certification verifying quality assurance in design/development and production in accordance with ISO 9001.

All materials, equipment, and parts shall be new and unused of current manufacture.

Provide all necessary accessories required for a complete and operable system.

WARRANTY
Wire and cable shall be warranted for a period of not less than 2 years from the date of commissioning against
defects in material and workmanship.
The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

GENERAL

Approved manufacturer:
Contractor’s option.

All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

WIRE AND CABLE – GENERAL PURPOSE (600V)

General:
THWN or THHN general purpose building wire insulated with polyvinyl chloride (PVC) and covered with protective sheath of nylon intended for lighting and power circuits at 600 volts or less, in residential, commercial, and industrial buildings.

The wire shall be suitable for 90°C maximum continuous conductor temperature in dry locations and 75°C in wet locations and listed by Underwriters Laboratories for use in accordance with Article 310 of the National Electrical Code.

Conductors:
Class B or Class C stranded, annealed uncoated copper per UL Standard 83 or 1063.

Where aluminum conductors are allowed, aluminum alloy conductors shall be compact stranded conductors of a recognized Aluminum Association 8000 Series aluminum alloy conductor material (AA-8000 series alloy).

Insulation:
Each conductor shall be insulated with PVC and sheathed with nylon complying with the requirements of UL Standard 83 for Types THHN or THWN and UL Standard 1063 for Type MTW and CSA C22.2 No. 75 for T90 Nylon.

Types THWN or THHN shall comply with the optional Gasoline and Oil Resistance rating of UL Standard 83. The insulation shall also comply with UL requirements for 105°C Appliance Wiring Material.

The average thickness of PVC insulation, for a given conductor size, shall be as specified in UL Standard 83 for THWN or THHN. The minimum thickness at any point, of the PVC insulation, shall be not less than 90 percent of the specified average thickness.

The minimum thickness at any point of the nylon sheath shall be as specified in UL Standard 83 for Types THWN or THHN.

The PVC insulation shall be applied tightly to the conductor and shall be free-stripping.
Identification:
The wire shall be identified by surface marking indicating manufacturer's identification, conductor size and metal, voltage rating, UL Symbol, type designations, and optional ratings. The wire shall also be identified as C (UL) Type T90 Nylon or TWN 75, FT1.

Tests:
Wire shall be tested in accordance with the requirements of UL Standard 83 for Types THWN or THHN wire and for the optional Gasoline and Oil Resistance listing; as Type MTW to UL Standard 1063 (stranded items): as AWM to UL Standard 758 (stranded items); and as C(UL) Type T90 Nylon or TWN 75.

Usage:
General use power wiring, minimum size No. 12 AWG.

General use control wiring, minimum size No. 14 AWG.

WIRE AND CABLE – UNDERGROUND (600V)
General:
USE-2 or XHHW-2, cross linked, polyethylene insulated cables for use in circuits; not exceeding 600 volts. Cables listed by UL as Type USE-2 and recognized for underground use in wet locations at a maximum continuous conductor temperature of 90°C in accordance with Article 338 of the National Electric Code.

Installed in air, conduit, or other recognized raceways in accordance with Article 310 of the National Electric Code.

Conductors:
Conductors shall be Class B stranded annealed uncoated copper per UL Standard 854 and 44.

A suitable separator over the conductor may be used at the option of the manufacturer.

Insulation:
Each conductor shall be insulated by surface marking indicating manufacturer’s identification, conductor size and metal, voltage rating, UL Symbol, and type designations.

Tests:
Wire shall be tested in accordance with the requirements of UL Standard 8654 for Type USE-2, UL Standard 44 for Types XHHW-2.

Usage:
Underground power wiring, minimum size No. 12 AWG.

WIRING CONNECTORS
Polaris Type Mechanical Connectors:
8 AWG and larger wire for all motor connections.

Spring Wire Connectors:
10 AWG and smaller wire.

Compression Connectors (T&B Sta-Kon or equal):
For those devices that are not rated to accept stranded wire.

EXAMINATION
Verify that wire is in compliance with specifications.
Verify that interior of building has been protected from weather.

Verify that mechanical work likely to damage wire and cable has been completed.

Inspect wire for physical damage and proper connection.

Measure tightness of bolted connections and compare torque measurements with manufacturer’s recommended values.

Verify continuity of each conductor.

Feeder or branch circuits with ampacity greater than 100 amperes shall be tested after installation to measure insulation resistance of each conductor.

   All equipment shall be disconnected and the wire ends shall be cleaned and dried.

   Connect Megohmeter between conductor and a grounded point in the enclosure and energize until the reading stabilizes.

   The Megohmeter reading for each conductor shall not be less than 10,000 Megohms.

FIELD MEASUREMENTS
Field verify all measurements. Do not base on contract drawings.

Identify conflicts with the work of other trades prior to installation of work.

Adjust system to satisfy field requirements.

DELIVERY, STORAGE AND HANDLING
Receive, sign for and store all equipment in this section.

Maintain original quality and condition of wire while it is in storage.

INSTALLATION
General:

   The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.

   Install all materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

Pre-Installation:

   Verify that interior of building has been protected from weather.

   Verify that mechanical work likely to damage wire has been completed.

   Completely and thoroughly swab raceway prior to installation.

   Verify that field measurements are as shown on drawings.

   Wire and cable routing shown on drawings is approximate unless dimensioned. Route wire and cable to satisfy project conditions.
Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

Determine required separation between cable and other work.

Determine cable routing to avoid interference with other work.

Conductor Sizing:
Conductor sizes are based on copper.

Use conductor not smaller than No.12 AWG for power and lighting circuits.

Use No.10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.

Use No. 10 AWG conductors for 20 ampere, 277-volt branch circuits longer than 200 feet.

Where circuit wiring length exceeds 100 feet, increase wire size as needed to maintain a maximum voltage drop of three percent.

Use conductor not smaller than No.14 AWG for control circuits.

Wire and cable size shall be increased from size indicated or required by code to meet the following voltage drop requirements:

- 3% drop for branch circuits.
- 5% drop for motor circuits.

Wire Pulling:
Pull all conductors into raceway at same time.

No.4 AWG and larger wire and power cables shall be lubricated with pulling lubricant to reduce pulling tension and abrasion damage. The lubricant shall be water or wax based containing no oils or greases that may adversely affect cable jackets.

The minimum bend radius and maximum pulling tension ratings of the wire and cable shall not be exceeded.

Splices and Terminations:
Splices and terminations shall not be made within raceways.

Clean conductor surfaces before splicing or terminating.

Make splices, taps, and terminations to carry full amp capacity of conductors with no perceptible temperature rise.

Wire nuts, “ScotchLocks”, and similar devices may be used to splice 120V power circuits.

Control, communication, and data transmission wire and cable shall not be spliced.

Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels or support for the ceiling suspension system per NEC.

Neatly train and lace wiring inside boxes, equipment, and panelboards.
Clean conductor surfaces before installing lugs and connectors.

Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

Use polaris type mechanical connectors for copper conductor splices and taps, 8 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

Motors:

Motor wiring to motors less than 10 horsepower shall be spliced and terminated with fully insulated crimp-on end cap with a layer of self-vulcanizing rubber tape, followed by five layers of vinyl electrical tape. “SkotchLocks” and similar devices shall not be used.

Motor wiring to motors 10 horsepower or larger shall be spliced and terminated with crimp-on ring terminal lugs, brass nuts, bolts and washers with a layer of self-vulcanizing rubber tape, followed by five layers of vinyl electrical tape. “SkotchLocks” and similar devices shall not be used.

Wire Marking:

The ends of each conductor shall be marked with circuit number, motor number, wire or terminal number.

Labels shall be typed in black lettering with indelible ribbons on a white, heat shrink sleeve. Markers shall be shrunk around the wire to provide a tight, non-slip bond with a compatible heat gun.

Heat shrink wire markers shall be Brady Bradysleeve Type B-321 or B-322

Color Coding:

Color coding shall be as follows:

<table>
<thead>
<tr>
<th>480Y/277V</th>
<th>120/240V</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Ø System</td>
<td>1Ø System</td>
</tr>
<tr>
<td>Phase A</td>
<td>Brown</td>
</tr>
<tr>
<td>Phase B</td>
<td>Orange</td>
</tr>
<tr>
<td>Phase C</td>
<td>Yellow</td>
</tr>
<tr>
<td>Neutral</td>
<td>Gray</td>
</tr>
<tr>
<td>Ground</td>
<td>Green</td>
</tr>
</tbody>
</table>

Ground Wire Color Coding:

Provide green insulated ground wire for #8 and smaller. #6 wire shall have green band per code.

* * * * *
SECTION 26 05 26
GROUNDING

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1
specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
Conform to current Underwriters Laboratories (UL) Specifications and Standards.
Conform to National Electrical Contractors Association (NECA) “Standards of Installation”.
Product specific standards and requirements are included in product specifications.

DESCRIPTION OF WORK
Furnish and install a complete and operable grounding and bonding system as indicated on drawings and specified
herein.
Ground and bond all equipment required per all applicable codes whether or not specifically shown on drawings.

RELATED WORK ELSEWHERE
Division 26: Electrical

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.

WARRANTY
The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract
Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the
requirements of the Contract Documents.
The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts
cost, etc.
Submit a written warranty executed by the installer indicating ground test was completed.

PART 2 - PRODUCTS

GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the
manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new
(less than 1 year old when turned over to the Owner).
Provide a complete and fully functional grounding system using materials and equipment of types, sizes, and rating as required to meet performance requirements. Use materials and equipment that comply with referenced standards and manufacturer’s standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions. Provide all accessories necessary for a fully functioning system.

**GROUND RODS**
Material: Copper-clad steel.

Diameter: 3/4" minimum.
Length: 10’ minimum. Rod shall be driven at least 9’5” deep.

**MECHANICAL CONNECTORS**
The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers, and lockwashers shall be made of silicon bronze and supplied as a part of the connector body and shall be of the two bolt type.

Split bolt connector types are not allowed.

The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

**COMPRESSION CONNECTORS**
The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99 percent.

The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.

The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.

The connectors shall be clearly marked with the manufacturer, catalog number, conductor size, and the required compression tool settings.

Each connector shall be factory filled with an oxide-inhibiting compound.

**EXOTHERMIC CONNECTIONS**
Select the appropriate kit for specific types, sizes, and combinations of conductors and other items to be connected. Field personnel shall be trained in execution of welds.

**WIRE**
Material: Stranded copper (aluminum permitted only with aluminum conductors).

Grounding Electrode Conductor: Size as shown on drawings, specifications, or required by NFPA 70, whichever is larger.

**PART 3 - EXECUTION**

**EXAMINATION**
Inspect grounding and bonding system conductors and connections for tightness and proper installation.
FIELD MEASUREMENTS
Field verify exact routing of all backbone cable.

Adjust grounding system installation to satisfy field requirements.

DELIVERY, STORAGE AND HANDLING
Receive, sign for and store all equipment in this section.

INSTALLATION
General:
Provide a separate, insulated equipment grounding conductor in all raceways.

Receptacle grounding:
For all receptacle circuits, provide separate green ground wire in raceway system.
Standard receptacles may be used and green wire shall be directly connected to receptacle or to pigtail.
Provide #12 pigtail to ground all metal boxes.
Stranded wire twisted on ground terminal on device is not allowed.

Ground Rod Installation:
Install ground rods to be 10’6” deep.

* * * * *
SECTION 26 05 29
SUPPORTING DEVICES

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
Conform to current American National Standards Institute (ANSI) standards.
Conform to current American National Standards Institute ANSI B31.1 standards.
Conform to National Electrical Contractors Association (NECA) “Standards of Installation”.

DESCRIPTION OF WORK
Furnish and install complete and operable support devices as required.
Metal supporting devices shall be zinc galvanized or cadmium plated steel or malleable iron.
Equipment and materials shall be supported with devices designed for such purpose. Wire or plastic ty-raps area not acceptable.
Where so specified on the drawings, provide stainless steel, PVC covered, or hot dipped galvanized.
Refer to drawings or other portions of the specifications for particular pieces of equipment which may require more stringent equipment specifications than listed in this specification.

RELATED WORK ELSEWHERE
Division 26: Electrical

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.

All materials, equipment and parts are to be new, undamaged and unused of current Manufacture.

WARRANTY
Equipment shall be warranted for a period of not less than 2 years from the date of commissioning against defects in material and workmanship.
The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.
The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.
PART 2 - PRODUCTS

GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

LIGHTING FIXTURE SUPPORT
Provide items such as stems, hickeys, bar hangers, and clips required to securely attach fixtures to ceilings or walls.

Provide spacers or stabilizers to eliminate fixture instability.

Drilled expansion insert type anchors suitable for load and application requirements such as sleeve anchors, lag shields, and plastic anchors.

Provide auxiliary supports so fixtures can be drawn up tightly, tilted or rotated, and not affected by vibrations.

SUPPORTING STRUCTURES
Rack supports of galvanized steel channel sections with adequate feet to allow secure mounting.

Weld sections, do not use bolts.

CONDUIT SUPPORTS
1-hole galvanized steel straps for EMT, 2-hole galvanized steel straps for all other conduits. Do not use perforated hanger iron.

PART 3 - EXECUTION

EXAMINATION
Verify locations prior to rough in.
Verify mounting details

FIELD MEASUREMENTS
Verify that field measurements are as shown on Drawings.

DELIVERY, STORAGE AND HANDLING
Receive, sign for and store all equipment in this section.
Accept equipment on site. Inspect for damage.
Protect equipment from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

INSTALLATION
General:
The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.
Install all materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.
Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
Do not fasten supports to pipes, ducts, mechanical equipment, or other conduit.

Do not use spring steel clips on ceiling support wires.

Do not use powder actuated anchors.

Obtain permission from Architect before drilling or cutting structural members.

Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present a neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

Install surface mounted cabinets and panelboards with minimum of four anchors.

In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.

Use steel metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

Degrease and clean surfaces to receive nameplates and labels.

Install nameplate and label parallel to equipment lines.

Secure nameplates to equipment fronts using screws if so specified on drawings.

Anchors:

- Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31 and transfer of loading and stresses to connected equipment.

- Installation methods shall be in conformity with manufacturer’s recommendations for maximum holding power.

Conduit Supports:

- Support conduit as follows:
  - Vertical Surfaces: Galvanized, heavy-duty, sheet steel straps.
  - Horizontal Surfaces: Single or double rack channel trapeze, complete with conduit straps as required; supported with threaded hanger rods.

* * * * *
APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
Conform to current National Electrical Manufactures Association (NEMA) Standards.
Conform to current Underwriters Laboratories (UL) Specifications and Standards.
Conform to current Telecommunication Industry Association (TIA/EIA).
Conform to current American National Standards Institute (ANSI) standards.
Conform to National Electrical Contractors Association (NECA) “Standards of Installation”.
Product specific standards and requirements are included in Product Specifications.

DESCRIPTION OF WORK
Furnish and install a complete and operable conduit/raceway system as indicated on the drawings and as specified herein.
All wire shall be in conduit or surface raceway. All conduit in finished areas shall be concealed.
In unfinished areas, such as utility and mechanical rooms, the contractor shall conceal the branch wiring such as receptacles and light switches.
Where conduit passes through areas of differing temperatures, such as into or out of cool-rooms, freezers, unheated and heated spaces, buildings, provide listed conduit seals to prevent the passage of moisture and water vapor through the conduit.
When remodeling in existing construction, all conduit shall be concealed in walls, above ceiling, or below floors and located within building.

Materials Included:
  Metal conduit.
  Flexible metal conduit.
  Liquidtight flexible metal conduit.
  Electrical metallic tubing.
  Nonmetallic conduit.

RELATED WORK ELSEWHERE
Division 26: Electrical
SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.

OPERATION & MAINTENANCE MANUALS
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.

All materials, equipment and parts are to be new, undamaged and unused of current manufacture.

WARRANTY
Equipment shall be warranted for a period of not less than 2 years from the date of commissioning against defects in material and workmanship.

The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

CONDUIT GENERAL REQUIREMENTS
Minimum Size: 1/2 inch.

Conduit types not listed below are prohibited.

Rigid heavy wall galvanized steel conduits:
Are to be used in the following locations:
   Outdoors.
   Underground, unless PVC is shown on drawings or called out in other portions of this specification.
   In and under ALL concrete slabs, except for where PVC is allowed as stated in nonmetallic conduit portion of this specification.
   In areas having moisture, dust or gases.
   Exposed conditions where such mechanical protection is required.

Manufacturer:
   CONTRACTOR option.

Conduit:
   Impact and crush resistant mild steel tube with an accurate circular cross section, a uniform wall thickness, a defect free interior surface, and a continuous welded seam.
Interior and exterior surfaces thoroughly and evenly coated with zinc using the hot-dip galvanizing process.

Top-coated with a compatible organic layer to inhibit white rust and increase corrosion resistance.

Factory cut threads, 0.75-inch taper per foot, protected after cutting with an application of molten zinc.

Conduit Bodies:
Ferrous metal construction electro-galvanized inside and out and coated with aluminum acrylic paint.

Tapered, threaded hubs with integral bushing.

Stainless steel hardware.

Cover constructed of same material with solid gasket.

Fittings:
Ferrous metal construction electro-galvanized inside and out.

Components critical to performance such as set screws, split rings, and locknuts constructed of hardened steel or adequately designed to insure positive bonds.

EMT (Electrical Metallic Tubing):
May be used in the following locations:
Indoors in dry locations (walls, ceilings).

Wet locations above grade.

Manufacturer:
CONTRACTOR option.

Conduit:
Mild steel tube with an accurate circular cross section, a uniform wall thickness, a defect free interior surface, and a continuous welded seam.

Interior and exterior surfaces thoroughly and evenly coated with zinc using the hot-dip galvanizing process.

Fittings:
Setscrew, steel construction electro-galvanized inside and out.

Insulated throat connectors.

Components critical to performance such as set screws, split rings, and locknuts constructed of hardened steel or adequately designed to insure positive bonds.

Weatherproof couplings and connectors. All supports shall be corrosion resistant. All hardware shall be stainless steel.

Flexible Metal Conduit:
Lengths limited to minimum necessary, 6' maximum.
Limit use to dry areas.

For connection of lighting fixtures, motors and similar equipment.

To contain an equipment grounding conductor with phase conductors.

Bond grounding conductor to equipment served and nearest conduit system junction box.

Manufacturer:

CONTRACTOR option.

Usage:

Use only in conjunction with electrical metallic tubing

Conduit:

Single strip, helically wound, galvanized steel with smooth interior surface conforming to applicable UL Standards.

Minimum size 1/2-inch may be used in lengths not to exceed 3-feet. All runs of flexible conduit shall be as short as practicable, of the same size as the conduit it extends and with enough slack to reduce the effects of expansion and vibration.

Fittings:

Connectors shall be malleable iron or steel with insulated throat, squeeze-type, with annular gripping rib. Particular attention shall be given to maintaining ground bond and firm support through flexible connections. Connections shall have insulated throats.

Liquid Tight Flexible Metal Conduit:

Requirements same as for flexible conduit.

Use in areas where environment is damp or could become damp or wet.

To contain an equipment grounding conductor with phase conductors. Bond grounding conductor to equipment served and nearest conduit system junction box.

Manufacturer:

CONTRACTOR option.

Usage:

Use in conjunction with galvanized rigid metal conduit.

Use in conjunction with PVC coated galvanized rigid metal conduit.

Conduit:

Single strip, helically wound, galvanized steel core inside and outside with smooth interior surface with sunlight resistant thermoplastic jacket suitable for ambient environmental conditions conforming to applicable UL Standards.

Jacket shall be positively locked to core to prevent sleeving.

All runs of flexible conduit shall be as short as practicable, of the same size as the conduit it extends and with enough slack to reduce the effects of expansion and vibration.
Fittings:

Where used in conjunction with galvanized rigid metal conduit, connectors shall be malleable iron or steel, electro zinc plated, with insulated throat and taper threaded hub.

Where used in conjunction with PVC coated galvanized rigid metal or rigid aluminum conduit connectors shall be malleable iron or steel, electro zinc plated and PVC coated, with insulated throat and taper threaded hub.

Particular attention shall be given to maintaining ground bond and firm support through flexible connections.

All fittings shall be liquid tight.

Nonmetallic Conduit (PVC):

Where indicated on drawings.

In or under concrete slabs.

PVC conduit may be used for low voltage wiring (24 volts or less), where allowed by code. PVC may not be used in plenum rated ceilings or if another type has been called out on the drawings.

Where PVC conduit penetrates floor, it must be installed per conduit installation detail.

Manufacturer:

Carlon.

Or equal.

Conduit:

Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.

Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-2.

The conduit and fittings shall be homogeneous plastic material free from visible cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections, which could mar conductors or cables.

Conduit, fittings and cement shall be produced by the same manufacturer to assure system integrity.

Conduit Bodies:

Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.

Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-3.

Stainless steel hardware.

Cover constructed of same material with solid gasket.
Fittings:
Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.
Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-3.

**METAL CONDUIT**
Rigid Steel Conduit: ANSI C80.1.
Intermediate Metal Conduit (IMC): Rigid steel.
Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit all steel fittings.

**FLEXIBLE METAL CONDUIT**
Description: Interlocked steel construction.
Fittings: ANSI/NEMA FB 1.

**LIQUIDTIGHT FLEXIBLE METAL CONDUIT**
Description: Interlocked steel construction with PVC jacket.
Fittings: ANSI/NEMA FB 1 with insulated throats.

**ELECTRICAL METALLIC TUBING (EMT)**
Description: ANSI C80.3; galvanized tubing.
Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel or malleable iron, insulated throat connectors.

**NONMETALLIC CONDUIT**
Description: NEMA TC 2; Schedule 40 PVC.
Fittings and Conduit Bodies: NEMA TC 3.

**PART 3 - EXECUTION**

**EXAMINATION**
Verify routing and termination locations of conduit prior to rough in.
Verify conduit routing. Routing as shown on Drawings is in approximate locations unless dimensioned. Route as required to complete wiring system.

**FIELD MEASUREMENTS**
Field verify all measurements. Do not base conduit rough-in or equipment locations on dimensions obtained from the contract drawings.
Identify conflicts with the work of other trades prior to installation of electrical equipment and conduit work.
Adjust conduit system installation to satisfy field requirements.

**DELIVERY, STORAGE AND HANDLING**
Receive, sign for and store all equipment in this section.
Accept conduit on site. Inspect for damage.
Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

Protect PVC conduit from sunlight.

**INSTALLATION**

General:

The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.

Install all materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

All conduit shall be installed in building unless indicated otherwise.

All conduits stubbed into ceiling shall have end bushings.

Install conduit in accordance with NECA "Standard of Installation."

Install nonmetallic conduit in accordance with manufacturer's instructions.

Arrange supports to prevent misalignment during wiring installation.

Support conduit using coated steel or malleable iron straps, lay in adjustable hangers, clevis hangers, and split hangers.

Group related conduits: support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

Fasten conduit supports to building structure and surface under provisions of Section 26 05 29.

Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

Do not attach conduit to ceiling support wires.

Arrange conduit to maintain headroom and present neat appearance.

Route exposed conduit parallel and perpendicular to walls.

Route conduit in and under slab from point to point.

Do not cross conduits in slab.

Maintain adequate clearance between conduit and piping.

Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.

Cut conduit square using saw or pipecutter; de burr cut ends.

Bring conduit to shoulder of fittings; fasten securely.
Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cleaner and cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Hydraulic one-shot bender may be used to fabricate factory elbows.

Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.

Provide suitable pull string in each empty conduit, except sleeves and nipples.

Use suitable caps to protect installed conduit against entrance of dirt and moisture.

Ground and bond conduit under provisions of Section 26 05 26.

Identify conduit under provisions of Section 26 05 53.

Flexible metal conduit shall be used for connection to equipment subject to vibration and light fixture drops in all removable tile ceilings. Length shall not exceed 36" for equipment connections and 72" for light fixture connections. Minimum size 1/2", except 3/8" may be used for fixture drops. Install flexible conduit drops from independent junction box mounted above ceiling and accessible from below ceiling to recess ceiling mounted equipment. Allow for positioning of equipment to next tile increment.

Seal conduit with oakem or duct seal where they leave heated areas and enter unheated areas.

Surface raceway shall be installed to run parallel of all existing surfaces. Where raceway is used on ceiling, raceway shall be mounted at ceiling wall junction and extended from the junction box out to ceiling mounted device. Raceway shall be routed in corners and along moldings to be as least obtrusive as possible.

Exterior cable and conduit installation.

Layout in trench may be started at either end unless the drawings indicate that it is to pitch for drainage. In which case the layout should be started at the lowest end. The cable and conduit shall be pitched 1" per 100 feet.

Include all excavation and backfill.

Cable and conduit shall be a minimum of 30" deep.

Cable and conduit shall be laid in a 6" sand bed and covered with another 6" of sand before backfilling with earth.

Provide Brady identotape 12" above all buried conduits and cables.

Provide #12 pull wire in all empty or spare conduits.

Restore existing surface back to its original condition.

For all excavation, maintain erosion protection per Federal, State, and municipal requirements.
All work associated with erosion control for excavation shall be done as per Federal, State and 
municipal requirements, as well as any plans, meetings, and other special conditions.

For all trenching that is under paved surfaces, backfill with structural material. Material shall be 
tapped in layers up to the point of the surface paving material.

For on-grade slabs, the conduit may be run in or under the slab. Verify with concrete installation prior to 
running conduits in slab to determine if that conduit coordinates with the slab reinforcing.

Exterior Wall Penetrations:
For all exterior wall penetrations, patch the wall with material to match the existing wall finish. The 
openings shall be as small as possible to minimize the impact on the existing wall finish. Install duct seal 
within the conduit to prevent air flow.

When conduits are rising from the ground to penetrate the walls, furnish rigid steel conduit where conduit 
is exposed, and deep-back LB's conduletes or NEMA 4X stainless steel junction box.

Interface with Other Products:
Install conduit to preserve fire resistance rating of partitions and other elements.

Route conduit through roof openings for piping and ductwork or through suitable roof jack. Coordinate 
location with roofing installation.

* * * * *
SECTION 26 05 35
ELECTRICAL BOXES

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
Conform to current National Electrical Manufacturers Association (NEMA) Standards.
Conform to current Underwriters Laboratories (UL) Specifications and Standards.
Conform to National Electrical Contractors Association (NECA) “Standards of Installation”.

DESCRIPTION OF WORK
Furnish and install boxes as indicated on drawings and specified herein.
The intent of this section is to limit the use of sheet steel boxes to small circuit wiring in dry locations for installations of outlets, switches, exhaust fans, lights, unit heaters, small overhead door units, small power outlets, and limiting the general circuit capacity of 50 amps or less.

RELATED WORK ELSEWHERE
Division 26: Electrical

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.

OPERATION & MAINTENANCE MANUALS
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.
All materials, equipment and parts are to be new, undamaged and unused of current Manufacture.

WARRANTY
Equipment shall be warranted for a period of not less than 2 years from the date of commissioning against defects in material and workmanship.
The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.
The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS
GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the
manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new
(less than 1 year old when turned over to the Owner).

BOXES
Pull boxes and junction boxes: Metal construction, conforming to National Electrical Code, with screw on or hinged
cover.

Flush mounted pull boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.
Small surface type junction boxes to be used in dry locations only for general purpose lighting and outlets shall
conform to the following standard sizes and spec's:
All boxes and covers shall be made of stamped steel. (No sectional boxes allowed).

Minimum sizes:
Handy boxes 4 x 2-1/8 x 2-1/8
Octagon boxes 4 x 1-1/2
4" sq. boxes 4 x 1-1/2 or 4 x 2-1/8
4-11/16" sq. boxes 4-11/16 x 2-1/8

Flush mounted outlet boxes used in dry locations shall conform to the following standards:
All boxes and covers shall be made of stamped steel. No sectional boxes allowed.

Minimum sizes:
Masonry boxes: minimum 3 1/2" deep, gang as required. These can be used for outlets or blank
outlets.
4" square wiring device boxes: 2 1/8" deep. All 4" square boxes shall be equipped with square cut
1" raised covers of appropriate depth.

Note special requirements for boxes that will be used in corrosive atmospheres, such as pools. In
these atmospheres use corrosion resistant (PVC) outlet boxes.

Note special requirements for flush boxes for outside receptacles. These boxes shall be 4-hole
type or other type to properly patch the surface weather tight covers.

Junction and Splice Boxes:
Screw covers, galvanized after fabrication and not less than code dimensions.
Entry openings in boxes shall be made with knock-out punches or hole saws.
Burning of entry openings with a torch will not be acceptable.
Paint exposed ferrous surfaces, 2 coats rust resisting paint.

Provide outlet box divider barriers between 277/480 and 120/208 devices per N.E.C. and between switches for
emergency and non-emergency circuits.
Flush interior devices shall utilize 4" square box with raised covers or deep masonry boxes as appropriate.
Raised covers to have square cut corners.
Where existing boxes are reused, provide add-a-depth device rings to devices installed without proper box depth to
finish surface.
Box extensions will not be allowed.

Junction boxes and pull boxes shall not have knockouts. Enclosure type, material, and dimensions shall be as indicated on the drawings and as stated in these specifications. Where no type or size is indicated for junction boxes and pull boxes, they shall be one size larger than required by NEC.

For exterior outlets, such as receptacles, use FS type outlet box flush or surface mounted.

Large junction boxes shall be constructed from steel in the following gauges:

<table>
<thead>
<tr>
<th>Box Size</th>
<th>Minimum Steel Gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 24&quot; x 30&quot; x 12&quot;</td>
<td>14</td>
</tr>
<tr>
<td>24&quot; x 36&quot; x 8&quot; to 36&quot; x 36&quot; x 16&quot;</td>
<td>12</td>
</tr>
<tr>
<td>36&quot; x 42&quot; x 8&quot; and larger</td>
<td>11</td>
</tr>
</tbody>
</table>

Boxes that are shown on hollow-core, precast concrete shall be flush mounted into the spancrete unless shown otherwise on drawings. Coordinate opening to be in hollow core. Provide opening.

**PART 3 - EXECUTION**

**EXAMINATION**
Verify routing and termination locations of conduit prior to rough in.

**FIELD MEASUREMENTS**
Verify that field measurements are as shown on Drawings.

Mounting heights:
- As shown on drawings and details.
- Coordinate exact heights with specific manufacturer’s recommendations.
- All mounting heights of keypads and pushbuttons to be ADA compliant.

**DELIVERY, STORAGE AND HANDLING**
Receive, sign for and store all equipment in this section.

Maintain original quality and condition of equipment while it is in storage.

**INSTALLATION**
**General:**
The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.

Install all materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

Boxes that are being installed in rough masonry surfaces (such as split face block) shall be installed in such a manner to allow the wiring device or light fixture and the associated device plate to be seated squarely. Have the masonry opening cut to the size of the plate and then box grouted in, or the rough masonry around the box shall be chiseled away and mortar installed around the box to provide a flat finish.
Coordinate with the masonry installation all details of installation on rough masonry surfaces. Without coordination assume responsibility for all costs to provide the flat surface, which will require chiseling the surface of the rough masonry away and providing mortar to obtain this smooth finish.

Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

Install electrical boxes to maintain headroom and to present neat mechanical appearance.

Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods compatible with NFPA.

Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices with each other.

Use flush mounting outlet boxes in finished areas.

Support boxes independently of conduit.

Use gang box where more than one device is mounted together. Do not use sectional box.

Use cast outlet box in exterior locations exposed to the weather and wet locations.

Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.

    Interior Dry Locations: Use hinged enclosure.

    Other Locations: Use surface mounted cast metal box.

Grounding:

    All equipment shall be grounded in accordance with NEC, these specifications and drawings, and the equipment supplier’s recommendations.

Interface with Other Products:

    Coordinate masonry cutting to achieve neat opening.

    Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

    Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

* * * * *
SECTION 26 05 37
LOCATION OF OUTLETS AND EQUIPMENT

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1
specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
Conform to National Electrical Contractors Association (NECA) “Standards of Installation”.

DESCRIPTION OF WORK
Furnish and install a complete installation as indicated on the drawings and as specified herein.
This specification lays out the general requirements for heights of devices. Heights of devices may be required to be
changed depending on interferences in the walls or interferences with mechanical or other architectural equipment.
Assume responsibility for verifying the existing conditions in the room by reviewing mechanical and architectural
drawings so as not to interfere with that equipment.
Verification of door swings: Assume responsibility to verify door swings with the architectural plans prior to outlet
box installation. Review if the switch location is such that it can be easily accessed upon opening the door.

RELATED WORK ELSEWHERE
Division 3: Concrete
Division 4: Masonry
Division 9: Finishes
Division 12: Furnishing
Division 23: Heating, Ventilation and Air Conditioning
Division 26, 27, and 28: Electrical
Division 17: Low Voltage

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.

OPERATION & MAINTENANCE MANUALS (NONE)

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.
All materials, equipment and parts are to be new, undamaged and unused of current manufacture.
All boxes to be plumb and level.

WARRANTY
Equipment shall be warranted for a period of not less than 2 years from the date of commissioning against defects in
material and workmanship.
The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts
cost, etc.
The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

EQUIPMENT
Specifications for equipment being installed under conditions set forth in this section shall be found in related work elsewhere.

PART 3 - EXECUTION

EXAMINATION
Verify installation locations suitability and adjust as directed.

FIELD MEASUREMENTS
Verify that field measurements are as shown on Drawings,

Mounting heights:
As shown on drawings and details.
Coordinate exact heights with specific manufacturer’s recommendations.
All mounting heights of keypads and pushbuttons to be ADA compliant.

DELIVERY, STORAGE AND HANDLING
Receive, sign for and store all equipment in this section prior to installation.

INSTALLATION
General:
The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.
Install all materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

Grounding:
All equipment shall be grounded in accordance with NEC, these specifications and drawings, and the equipment supplier’s recommendations.

Location:
Location of outlets and equipment as shown on plans is approximate. Verify exact location determined by:
Construction or code requirements.
Conflict with equipment of other trades.
Equipment manufacturer's drawings.
Minor modification to the location of outlets and equipment is considered a part of this specification and shall be made with no additional compensation.

Mounting heights for all devices and equipment to be measured from finished floor to center of device and unless otherwise noted on plans shall be as follows:

- **Switches**: 42"
- **Receptacles**: 22"
- **Above Counter receptacles**: - Mount just above backsplash for above counter outlets. See floor plan general notes.
- **Communication outlets**: - Match adjacent receptacle outlet. If receptacle outlet is not shown, provide 22" above floor to center of device or 8" above counter.
- **Wall Telephone**: 42"
- **Fire Alarm Horn/Strobe Signal**: 82" above the floor (shall be to the highest point in the space i.e. above highest riser level) or 6" below ceiling (whichever is lower)
- **Fire Alarm Pull Station**: 42"
- **Fire Xenon Strobe**: 82" above the floor (shall be to the highest point in the space i.e. above highest riser level) or 6" below ceiling (whichever is lower)
- **Wall Clocks**: 96" to top of box for classrooms, where indicated on plans
- **Blank Outlets**: - Match receptacle height located adjacent to it unless stated otherwise on plans

Check Heating and Ventilating Plans for location of baseboard heating elements or wall radiators and mount equipment accordingly.

Receptacles below counter: Verify the actual mounting height with architect. Determine if device is to fit into knee space and rough-in accordingly.

**Office Electrical Devices**

In each of the office spaces shown, the Owner will provide an actual layout of the room.

Electrical devices shall be rearranged in these rooms to accommodate the equipment.

Whenever the front counter is shown with receptacles within it, work with the counter manufacturer to cut the receptacles into the secretarial side of the counter.

These receptacles shall be cut into the face of the cabinet.

Provide all cutting and installation.
Counters shall be fed through the wall or through the floor.

* * * * *
SECTION 26 05 53
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1
specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
Conform to National Electrical Contractors Association (NECA) “Standards of Installation”.

DESCRIPTION OF WORK
Furnish and install complete labeling as specified herein.
All major pieces of electrical equipment shall have engraved labels indicating their functions. This shall include the
following:
  All pushbuttons shall have labels that are engraved as to its function.
  All panelboards, disconnects, and transformers shall have engraved labels indicating their functions.

RELATED WORK ELSEWHERE
Division 26: Electrical.

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.

OPERATIONS & MAINTENANCE MANUALS
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.
All materials, equipment and parts are to be new, undamaged and unused of current Manufacture.

WARRANTY
Equipment shall be warranted for a period of not less than 2 years from the date of commissioning against defects in
material and workmanship.
The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts
cost, etc.

PART 2 - PRODUCTS

GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the
manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new
(less than 1 year old when turned over to the Owner).
ENGRAVED LABELS
Where the words "provide engraved label" appears on the drawings or in the specifications, it shall mean that the label shall be an engraved 3-layer phenolic label with black letters on white material, unless other colors are called out on the drawings or details.

The label size shall be a minimum of 3/4" high and be 3" long. Labels may be attached with double backed adhesive tape unless indicated otherwise.

Where references are made on the drawings to provide engraved labels, engraved nameplate or engraved plates, these should be engraved phenolic labels.

ENGRAVED PLATES
Where references are made to engraved plates, this shall mean that the normal device plate shall have an engraving on it with black letters so as to indicate what this switch or device is used for.

BRANCH CIRCUIT OUTLETS: LABELING
Each branch circuit outlet, receptacles, lighting, and any other device requiring 120/208/277 or 480 volt power, the contractor shall:

- Provide circuit, written in pencil or non-washable ink, inside of outlet box in an area that can be easily viewed when removing outlet faceplate.
- Write circuit number in ink on device between receptacles under plate.
- Optional: Provide typed label (not dyno label) for each circuit attached to device plate.
- Label each junction box outlet cover in non-washable marker as to circuit number routed through junction box.

PANELBOARDS: LABELING
Panelboard Directory:

- Prepare and affix a typewritten directory to the inside cover of each panelboard indicating loads controlled by each circuit.
- Each distribution and lighting panelboard shall be equipped with a typewritten directory accurately indicating rooms and/or equipment being served.
- Assume that originally directories will have to be developed based on the room numbers on the project drawings.
- Near project completion, all directories will have to be changed to reflect actual room numbers as designated by the building occupant.
- Include the cost of doing the original handwritten directory and revisions to the directory based on occupant room numbers.
- Each existing panelboard that is revised, modified or has had circuits deleted or added to, shall have its directories retyped to reflect existing circuits and all modified circuits.
- Each changed circuit on existing panelboards shall have an asterisk next to the revised or modified circuits.

Panelboard Identification:

- Label per NEC 210.5.
- Identify each panel with a suitably engraved nameplate mounted at the top of the front cover.
The nameplates shall be made of laminated black and white plastic with white on the outside.

The lettering shall be 1/4 inch high (minimum), engraved by cutting through the white outside layer so that the letters appear black.

Fasten nameplates with brass or stainless steel panhead screws.

Nameplate engraving shall match the numbers or letters shown on the drawings or assigned by the Owner's Representative.

Labels shall be engraved as to the function of the circuit breaker.

Labels shall also be engraved to indicate the load served by the circuit breaker.

Identify the source of the feeder circuit serving the panelboard.

STARTERS AND DISCONNECTS
Each starter and disconnect furnished by this section or furnished by other sections but installed by this section shall have an engraved laminated label indicating which piece of equipment it controls.

This requirement is waived if the disconnect or starter is attached directly to the piece of equipment that it is controlling or operating.

MISCELLANEOUS
Branch Circuits:
On branch circuits, use shall be made of all standard wire insulation colors available.
Where wires of different systems junction in a common box, each cable shall be grouped with its own system and identified using tags or identification strips.

PART 3 - EXECUTION

EXAMINATION
Verify surfaces are cleaned and ready to receive labels.
Verify labels are correct.
Verify that labels are installed as specified, level and plumb.

DELIVERY, STORAGE AND HANDLING
Receive, sign for and store all equipment in this section.

INSTALLATION
General:
Degrease and clean surface prior to installing labels.
Install nameplate and label parallel to equipment lines.
Secure nameplates to equipment fronts using screws, if so specified on drawings.

* * * * *
SECTION 26 09 23
LIGHTING CONTROLS

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
Conform to requirements of current ANSI/NFPA 70 National Electrical Code.
Conform to current National Electrical Manufactures Association (NEMA) Standards.
Conform to current Underwriters Laboratories (UL) Specifications and Standards.
Conform to current NEMA Enclosure Standards.
Conform to NEMA Standard WD-7-2000.

DESCRIPTION OF WORK
Furnish and install a complete lighting control system as shown on the drawings and as specified herein. This equipment shall provide the following functions:

- Control of exterior lighting and select interior lighting with relays controlled by building automation system.

- Dual technology, PIR and ultrasonic motion sensor lighting controls.

- Photo sensors

RELATED WORK ELSEWHERE
Division 26

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.

The following information shall be submitted in addition to items listed above:

- Wiring diagram indicating wire size and type for each individual piece of equipment.

- Complete riser diagram indicating all equipment and interconnecting components with indication of location of each device.

- Submittal drawings are required for the following systems. They shall include the following:

  - Dual technology, Passive infrared and ultrasonic lighting controls.

  - Drawing showing all switches, and sensors and connections between all devices and lighting circuits.

  - Cut sheets on components.

  - Proper circuit numbers shall be shown on drawings.

OPERATION & MAINTENANCE MANUALS
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.
QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.

All materials, equipment and parts shall be new and unused of current manufacture.
Provide all necessary accessories required for a complete and operable system.

WARRANTY
Equipment shall be warranted for a period of not less than 2 years from the date of commissioning against defects in material and workmanship.
The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

PART 2 - PRODUCTS

DUAL TECHNOLOGY CEILING MOUNTED LIGHTING CONTROL
Provide dual technology type lighting controls in all areas unless directed to use single technology ultrasonic or passive infrared technology.

Determine proper sensor type and relay for direct connection requirements. Provide appropriate units.

Employ the services of a manufacturer’s appointed representative to assist in making the proper adjustments on the motion detector installation. Meet with this person prior to making installation to determine if the locations shown are appropriate for the type of device being furnished. Make modifications in the locations for the devices, if required, to provide a more adequate installation.

Modify time settings, sensitivity settings, and "initial on" and "keep on" controls as necessary, and as required for the space. Default time of 15 minutes “keep on” time will be used at initial activation.

Installation Assistance:
Include time in bid to work with the Owner and manufacturer to determine the proper time setting and sensor setting for each of the motion switches.

Each of the switches shall be set for the type of space in which they operate.

Include time in bid to have the manufacturer’s representative come on site and review the job to determine what the expected settings are for the equipment.

Zero crossing relay controls shall be supplied.

Dual technology occupancy sensors shall be capable of detecting presence in the floor area by detecting doppler shifts in transmitted ultrasound and passive infrared heat changes.

Ultrasonic sensing shall be volumetric in coverage.

Passive infrared sensing shall utilize a multi-element fresnel lens to ensure that the sensor is insensitive to short-wavelength infrared waves such as those emitted by the sun. Lens shall have grooves facing in to avoid dust and residue build up which affect its reception.

Both technologies shall sense presence in floor area before lighting will turn on. Detection by either technology shall hold lighting on for set period of time.
Sensors shall have time-out adjustment from 15 seconds to 35 minutes. Sensor shall not have settings exceeding 35 minutes.

Sensors shall cover 2000 square feet with standard lens and 90 linear feet with long-range lens for walking motion in corridors. Coverage meeting NEMA Standard WD 7-2000 will be required.

Sensors shall be capable of being networked to achieve adequate coverage.

Sensors shall have an isolated relay rated at 24VDC that can be used to interface with HVAC, EMS, and other monitoring systems.

Each sensing technology shall have independent sensitivity adjustments, time adjustments and led display.

Sensitivity and timer control shall be accessible on the front of the sensor. Sensor shall incorporate an accessible, but recessed on/override device.

Sensors shall operate on 24VDC.

Power supply shall be provided by a power pack that consists of a transformer and contact relay in one unit.

Provide 18 gauge plenum rated cable for interconnection of centers to relays.

Sensor shall have standard 5 year warranty and shall be UL listed.

All lighting motion sensors to be cold weather rated

Approved vendors are Watt Stopper or equal.

**AUTOMATIC PASSIVE INFRARED WALL SWITCH LIGHTING CONTROL**

Where so indicated, provide a passive infrared wall switch lighting control.

Determine proper sensor type and relay for direct connection requirements. Provide appropriate units.

Employ the services of a manufacturer’s appointed representative to assist in making the proper adjustments on the motion detector installation. Meet with this person prior to making installation to determine if the locations shown are appropriate for the type of device being furnished. Make modifications in the locations for the devices, if required, to provide a more adequate installation.

Modify time settings, sensitivity settings, and "initial on" and "keep on" controls as necessary, and as required for the space. Default time of 15 minutes “keep on” time will be used at initial activation.

Installation Assistance:

Include time in bid to work with the Owner and manufacturer to determine the proper time setting and sensor setting for each of the motion switches.

Each of the switches shall be set for the type of space in which they operate.

Include time in bid to have the manufacturer’s representative come on site and review the job to determine what the expected settings are for the equipment.

Confirm compatibility with all ballasts and fans used in conjunction with passive infrared wall switch.

Zero crossing relay controls shall be supplied.
Switch shall have processing capabilities designed to prevent false offs and false triggers.

Single relay and dual relay models shall be available. Dual relay models shall provide zero crossing relay controls only on the primary relay.

Load range 25 to 600 watts at 120 volts and 60 to 1200 watts at 277 volts.

Coverage area shall be 300 Sq. Ft.

Switch shall have option of auto on/off or manual on/auto off operation.

Switch shall have led passive infrared sensing indicator.

Timer to be set for 15 minutes and switch to be set in manual on/auto off mode at turn on.

Color shall be white to match wiring devices on project.

All lighting motion sensors to be cold weather rated

Approved vendors are Watt Stopper or equal.

PART 3 - EXECUTION

EXAMINATION
Verify equipment is in compliance with approved submittal drawings.

FIELD MEASUREMENTS (NONE)

DELIVERY, STORAGE AND HANDLING
Receive, sign for and store all equipment in this section.

INSTALLATION
General:
The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.

Install all fixtures, materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

Start of installation shall not begin until areas are broom clean, properly lighted, exterior enclosing walls in place, exterior windows glazed, roof completely installed to prevent weather damage to equipment.

Cleaning:
Prior to turning the system over to the Owner, the system shall be physically cleaned.

All appearance defects shall be carefully and professionally touched up so that the equipment is in “factory new” condition.

At the completion of the work, remove from the building and the premises all rubbish and debris resulting from the work.

Install products in accordance with manufacturer's instructions.
Install devices plumb and level.

Install switches with off position down.

Labeling:
- Each panel enclosure shall be labeled as to its function.
- Each bypass switch and bypass relay shall have engraved labels indicating their functions.

**INSTALLATION**

Install the work of this section in accordance with manufacturer’s printed instructions unless otherwise indicated.

Programming:
- Calibrate settings for time delay, sensitivity, fade rates, etc. to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted for 5 minutes after occupant leaves area.
- Set sensor and switching zones as required for application.
- Set time switch settings as required for application.
- Provide written or computer-generated documentation on the commissioning of the system including room by room description including:
  - Sensor parameters, time delays, sensitivities, and daylighting set points.
  - Sequence of operation (e.g. manual ON, Auto OFF, etc.)

  After 30 days of occupancy, re-calibrate all sensor time delays and sensitivities to meet the Owner’s Project Requirements. Provide a detailed report to the Architect / Owner of re-commissioning activity.

**Factory Services:**

Upon completion of the installation, the manufacturer’s factory authorized representative shall start up and verify a complete fully functional system.

The contractor shall provide both the manufacturer and the electrical engineer with 3 weeks written notice of the system start up and adjustment date.

Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the Owner’s personnel on the adjustment and maintenance of the system.

**OWNER TRAINING**

Provide complete operator training for the Owner’s personnel.

Provide minimum one hour training on the operation of each system in this section.

* * * * *
SECTION 26 22 00
TRANSFORMERS

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
NFPA70 – National Electrical Code.
National Electrical Contractors Association (NECA), Standard of Installation, current edition.
National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
NEMA ST20 - Dry type Transformers for General Applications.
Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
UL 1561 – Standard for Dry-Type General Purpose and Power Transformers.

DESCRIPTION OF WORK
Furnish and install complete and operable lighting and distribution type transformers as indicated on the drawings and as specified herein.

RELATED WORK ELSEWHERE
Division 26: Electrical

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.

OPERATION & MAINTENANCE MANUALS
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.
All materials, equipment and parts are to be new, undamaged and unused of current manufacture.
The lighting and distribution transformer manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

WARRANTY
Transformers shall be warranted for a period of not less than 2 years from the date of commissioning against defects in material and workmanship.
The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

PART 2 - PRODUCTS

GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

Provide 3R rated where called out on plans.

Approved manufacturers:
- Square D
- Cutler Hammer

Ratings:
Insulating materials shall exceed NEMA ST20 standards and be rated for 220 degree C, UL component recognized insulation system.
Transformers rated 15kVA and larger shall be 150 degree C temperature rise above 40 degree C ambient.
Transformers rated 25kVA and larger shall have a minimum of 4 - 2.5 percent full capacity primary taps.
The maximum temperature of the top of the enclosure shall not exceed 50 degree C rise above a 40 degree C ambient.
Transformer voltage and kVA ratings shall be as indicated on the drawings.

Energy Efficiency:
All transformers shall be low loss type with minimum efficiencies per NEMA TP1 and Department of Energy “Energy Star” Program when operated at 35 percent of full load capacity. Efficiency shall be tested in accordance with NEMA TP2.

Minimum transformer efficiency shall comply with the following table:

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<th>TRANSFORMER MINIMUM EFFICIENCY</th>
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Construction:
Transformer coils shall be of the continuous wound construction and shall be impregnated with
nonhygroscopic, thermosetting varnish.

All cores shall be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to
be kept well below the saturation point to prevent core overheating. Cores for transformers greater than
500kVA shall be clamped utilizing insulated bolts through the core laminations to ensure proper pressure
throughout the length of the core. The completed core and coil shall be bolted to the base of the enclosure
but isolated by means of rubber vibration-absorbing mounts. There shall be no metal-to-metal contact
between the core and coil and the enclosure except for a flexible safety ground strap. Sound isolation
systems requiring the complete removal of all fastening devices will not be acceptable.

The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding
conductor sized in accordance with applicable UL and NEC standards.

Separately mounted transformer enclosures shall be IP55 rated with a sealed non ventilated heavy gauge,
sheet steel construction. The entire enclosure shall be finished utilizing a continuous process consisting of
degreasing, cleaning and phosphatizing, followed by electrostatic deposition of polymer polyester powder
coating and baking cycle to provide uniform coating of all edges and surfaces. The coating shall be UL
recognized for outdoor use. The coating color shall be ANSI 49.

Sound Levels:
Sound levels shall not to exceed the following:
15 to 50kVA - 45dB
51 to 150kVA - 50dB
151 to 300kVA - 55dB
301 to 500kVA - 60dB
501 to 700kVA - 62dB
701 to 1000kVA - 64dB
1001 to 1500kVA - 65dB
1501 to 2000kVA - 66dB

PART 3 - EXECUTION

EXAMINATION
Verify equipment is in compliance with approved submittal drawings.

FIELD MEASUREMENTS
Field verify all measurements. Do not base exact conduit rough-in or equipment locations on the contract drawings.
Identify conflicts with the work of other trades prior to installation of transformers.

Adjust transformer installation to satisfy field requirements.

**DELIVERY, STORAGE & HANDLING**

Contractor to receive, sign for, and store all equipment in this section.

Contractor is responsible for maintaining original quality and condition of equipment while it is in storage.

Handle transformers using only lifting eyes and brackets provided for that purpose.

**INSTALLATION**

**General:**

The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.

Install all materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, etc. before installing.

Start of installation shall not begin until areas are broom clean, properly lighted, exterior enclosing walls in place, exterior windows glazed, and roof completely installed to prevent weather damage to equipment.

**Cleaning:**

Prior to turning the system over to the Owner, the system shall be physically cleaned.

All appearance defects shall be carefully and professionally touched up so that the equipment is in “factory new” condition.

At the completion of the work, remove from the building and the premises all rubbish and debris resulting from the work.

Take precautions such that the transformer vibration does not transmit into any building surfaces.

Transformer shall not be mounted tight against a wall; provide a minimum of 6” air space per NEC between the wall and the transformer.

The transformer shall be equipped with internal rubber isolating pads.

At the time that the transformer is set in place, loosen the hold-down bolts of the rubber isolating pads, as indicated per manufacturer’s instructions.

The transformer shall not be directly connected with rigid conduit, as indicated per manufacturer’s specifications.

All transformers shall be connected using flexible steel conduit with exception of transformer on scoreboard.

**Grounding:**

All equipment shall be grounded in accordance with NEC, these specifications and drawings, and the equipment supplier’s recommendations.

Measure primary and secondary voltages and make appropriate tap adjustments with 2-1/2 percent of the nominal operating voltage after the building is in full operation.
OWNER TRAINING

Provide complete operator training for the Owner’s personnel.

* * * * * *
SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
NFPA70 – National Electrical Code.
National Electrical Contractors Association (NECA), Standard of Installation, current edition.
National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
NEMA PB 1 - Panelboards
NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
NEMA AB 1 - Molded Case Circuit Breakers.
NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition:
UL 50 - Enclosures for Electrical Equipment
UL 67 - Panelboards.
UL 98 - Enclosed and Dead-front Switches
UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures
Canadian Standards Association (CSA), Specifications and Standards, current edition:
CSA Standard C22.2 No. 29-M1989 - Panelboards and Enclosed Panelboards
CSA Standard C22.2 No. 5-M91 - Molded Case Circuit Breakers
Federal Specifications and standards, current edition:
W-P-115C - Type 1 Class 1
W-C-375B - Molded Case Circuit Breakers
W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit and Service.
W-P115C - Type 1 Class 2 Load Center

DESCRIPTION OF WORK
Furnish and install complete and operable Distribution and Branch Circuit Panelboards system as indicated on the drawings and as specified herein.

RELATED WORK ELSEWHERE
Division 26, and 27: Electrical

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.
The following information shall be submitted in addition to the above:
Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
Overall panelboard dimensions, interior mounting dimensions, and wiring gutter dimensions. The location of the main, branches, and solid neutral shall be clearly shown. Illustrate one line diagrams with applicable voltage systems.

OPERATION & MAINTENANCE MANUALS
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.

The panelboard manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

All panelboards provided under this section shall be the products of a single manufacturer specializing in manufacture of panelboard products with a minimum of fifty years documented experience.

Provide all necessary accessories required for a complete and operable system.

WARRANTY
Panelboards shall be warranted for a period of not less than 2 years from the date of commissioning against defects in material and workmanship.

The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

Provide a complete and fully functional distribution system using materials and equipment of types, sizes, and rating as required to meet performance requirements. Use materials and equipment that comply with referenced standards and manufacturer’s standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

480VAC LIGHTING AND APPLIANCE PANELBOARDS
Manufacturers:
Square D Company NF - Class 1670
Eaton equal

Interior:
Rated 480Y/277 vac maximum. Continuous main current ratings, as indicated on drawings, not to exceed 600 amperes maximum for main breaker panelboards and not to exceed 800 amperes for main lug panelboards.
UL Listed short circuit current ratings as indicated on the drawings with a maximum of 200,000 RMS symmetrical amperes.

Provide one continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors limited to bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing shall be plated copper. Bus bar plating shall run the entire length of the bus bar.

All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.

A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided where indicated on the drawings.

Split solid neutral shall be plated and located in the mains compartment up to 250 amperes so all incoming neutral cable may be of the same length. UL Listed panelboards with 200 percent rated solid neutrals shall have plated copper neutral bus for non-linear load applications where indicated on the drawings.

Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twist-outs covering unused mounting space.

Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.

Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Interior leveling provisions shall be provided for flush mounted applications.

Interior phase bus shall be pre-drilled to accommodate field installable options such as sub-feed lugs, sub-feed breakers, thru-feed lugs.

Interiors shall accept 125 ampere breakers in group mounted branch construction.

Main Circuit Breaker:

Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40 degrees C ambient environment. Thermal elements shall be ambient compensating above 40 degrees C.

Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the breaker that allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.

Circuit breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.

Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position where indicated on the drawings.
Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 75 degree C rated wire or 90 degree C rated wire as required by the application. Lug body shall be bolted in place; snap-in designs are not acceptable.

The circuit breakers shall be UL Listed for use with and provided with the following accessories where indicated on the drawings: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

**Branch Circuit Breakers:**

Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the drawings.

Molded case branch circuit breakers shall have bolt-on type bus connectors.

Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.

There shall be two forms of visible trip indication. The circuit breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red indicator appearing in the clear window of the circuit breaker housing.

The exposed faceplates of all branch circuit breakers shall be flush with one another.

Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 75 degree C rated wire or 90 degree C rated wire as required by the application.

Breakers shall be UL Listed for use with and provided with the following accessories where indicated on the drawings: Shunt Trip, Auxiliary Switch, and Alarm Switch.

Circuit breakers shall be UL Listed with the following ratings where indicated on the drawings: (15-125A) Heating, Air Conditioning, and Refrigeration (HACR), (15-30A) High Intensity Discharge (HID), and (15-20A) Switch Duty (SWD)

**Enclosures:**

**Type 1:**

Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Galvannealed steel will not be acceptable.

Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.

Box width shall not exceed 26-inches wide.

**Type 1 Fronts:**

Front shall meet strength and rigidity requirements per UL 50 standards. Shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.

Fronts shall be hinged 1-piece with door. Mounting shall be flush or surface as indicated on the drawings.
Panelboards rated 250 amperes and below shall have fronts with concealed door hinges and trim screws. Front shall not be removable with the door locked. Panelboards rated above 250 amperes shall have vented fronts with concealed door hinges. Doors on front shall have rounded corners; edges shall be free of burrs.

Front shall have flat latch type lock with catch and spring loaded stainless steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.

**240VAC LIGHTING AND APPLIANCE PANELBOARDS**

Manufacturers:

- Schneider Square D NQ
- Eaton Cutler-Hammer

Interior:

- Rated for 240 VAC/48 VDC maximum. Continuous main current ratings, as indicated on the drawings, not to exceed 600 amperes maximum.
- UL Listed short circuit current ratings as indicated on the drawings with a maximum of 200,000 RMS symmetrical amperes.
- Provide one continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing shall be plated copper. Bus bar plating shall run the entire length of the bus bar. Main lug and main breaker panelboards shall be suitable for use as Service Equipment.
- All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.

- A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided where indicated on the drawings.
- Split solid neutral shall be plated and located in the mains compartment up to 225 amperes so all incoming neutral cable may be of the same length. UL Listed panelboards with 200 percent rated solid neutrals shall have plated copper neutral bus for non-linear load applications where indicated on the drawings.
- Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twist-outs covering unused mounting space.

Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.

Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Interior leveling provisions shall be provided for flush mounted applications.
Main Circuit Breaker:

Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40 degrees C ambient environment. Thermal elements shall be ambient compensating above 40 degrees C.

Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker that allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.

Circuit breaker handle and faceplate shall indicate rated ampacity. Circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.

Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position where indicated on the drawings.

Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 75 degree C rated wire or 90 degree C rated wire as required by the application. Lug body shall be bolted in place; snap-in designs are not acceptable.

The circuit breakers shall be UL Listed for use with and provided with the following accessories where indicated on the drawings: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

Branch Circuit Breakers:

Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the drawings.

Molded case branch circuit breakers shall have bolt-on type bus connectors.

Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.

There shall be two forms of visible trip indication. The breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red indicator appearing in the clear window of the circuit breaker housing.

The exposed faceplates of all branch circuit breakers shall be flush with one another.

Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 75 degree C rated wire or 90 degree C rated wire as required by the application.

Breakers shall be UL Listed for use with the following accessories where indicated on the drawings: Shunt Trip, Auxiliary Switch, and Alarm Switch.

Enclosures:

Type 1:

Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Galvannealed steel will not be acceptable.
Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.

Box width shall not exceed 26-inches wide.

Provide NEMA 3R where called out on plans

Type 1 Fronts:
Front shall meet strength and rigidity requirements per UL 50 standards. Shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.

Fronts shall be hinged 1-piece with door. Mounting shall be flush or surface as indicated on the drawings.

Panelboards rated 250 amperes and below shall have fronts with concealed door hinges and trim screws. Front shall not be removable with the door locked. Panelboards rated above 250 amperes shall have vented fronts with concealed door hinges. Doors on front shall have rounded corners; edges shall be free of burrs.

Front shall have flat latch type lock with catch and spring loaded stainless steel door pull. All lock assemblies shall be keyed alike. One key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.

PART 3 - EXECUTION

EXAMINATION
Verify equipment is in compliance with approved submittal drawings.
Examine area to receive panelboard to assure adequate clearance for panelboard installation.
Start work only after unsatisfactory conditions are corrected.
Inspect completed installation for physical damage, anchorage, and grounding.
Perform tests according to panelboard manufacturer’s instructions.
Tighten bus connections and mechanical fasteners.
Touch-up scratched or marred surfaces to match original finish.

FIELD MEASUREMENTS
Field verify locations of panelboards with other trades. Adjust as required to meet field conditions and code requirements. Do not base exact panelboard locations on the contract drawings.
Identify conflicts with the work of other trades prior to installation of electrical equipment.
Adjust panelboard installation to satisfy field requirements.

DELIVERY, STORAGE AND HANDLING
Receive, sign for and store all equipment in this section.
Do not store exposed to weather.
Physically protect against damage from work of other trades.
INSTALLATION

General:
The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable
codes and the manufacturer’s recommendations.

Start of installation shall not begin until areas are broom clean, properly lighted, exterior enclosing walls in
place, exterior windows glazed, roof completely installed to prevent weather damage to equipment.

Cleaning:
Prior to turning the system over to the Owner, the system shall be physically cleaned.

All appearance defects shall be carefully and professionally touched up so that the equipment is in “factory
new” condition.

At the completion of the work, remove from the building and the premises all rubbish and debris resulting
from the work.

Grounding:
All equipment shall be grounded in accordance with NEC, these specifications and drawings, and the
equipment supplier’s recommendations.

Install panelboards so that circuit breakers are not more than 6 feet above the finished floor or grade.

Selectively connect branch circuits to equally balance currents in the panelboard busses.

See Section 26 05 29 for equipment mounting.

Install panelboards plumb and flush with wall finishes.

Install panelboards such that top of panel is located at an elevation of 6-feet above finished floor elevation.

Provide filler plates for unused spaces in panelboards.

Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes
required to balance phase loads. See Section 26 05 53.

Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between
phases exceed 10 percent, rearrange circuits in the panelboard to balance the phase loads within 10 percent. Take
care to maintain proper phasing for multi wire branch circuits.

Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness
of connections for circuit breakers, fusible switches, and fuses.

Verify that bonding jumper is properly installed in service entrance rated panels.

Thoroughly clean and remove construction debris from panelboard interior and exterior.

OWNER TRAINING

Provide complete operator training for the Owner’s personnel.

Use submitted Operations & Maintenance manuals as reference during this demonstration and tour.
SPARE EQUIPMENT

As shown on panel schedules.

All spare breakers listed on panel schedules to be mounted in panelboards.

* * * * * *
APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
Conform to current National Electrical Manufactures Association (NEMA) Standards.
Conform to current Underwriters Laboratories (UL) Specifications and Standards.
Conform to National Electrical Contractors Association (NECA) “Standards of Installation”.

DESCRIPTION OF WORK
Furnish and install complete connections and wiring to motors as indicated on the drawings and as specified herein.
Check the drawings and specifications of all other divisions of work for equipment and work which must be included whether or not shown on the electrical drawings, in order to provide a complete electrical installation.
Install all motor starters and variable frequency drives.
Coordinate motor installation with other divisions of work.
Furnish overload devices for motor starters.

RELATED WORK ELSEWHERE
Division 23 – Heating, Ventilation and Air Conditioning.
Division 26, 27, and 28 – Electrical.

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.

OPERATION & MAINTENANCE MANUALS
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.
All materials, equipment and parts are to be new, undamaged and unused of current Manufacture.

WARRANTY
Installation shall be warranted for a period of not less than 2 years from the date of commissioning against defects in material and workmanship.
The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.
The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

EXAMINATION
Verify that equipment is in compliance with approved submittal drawings.

FIELD MEASUREMENTS (NONE)

DELIVERY, STORAGE AND HANDLING
Receive, sign for and store all equipment in this section.

INSTALLATION
General:
The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.

Install all materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

Motor starters shall be furnished by the division of work supplying the motor requiring a starter except where specifically stated otherwise on the electrical drawings.

Check the drawings and specifications of the other divisions to determine the requirements for motor disconnect switches and disconnects furnished by other divisions.

Install all required disconnect switches.

Provide all code required disconnect switches not specifically supplied by others.

Unless otherwise indicated on the drawings or elsewhere in these specifications, all motors shall be furnished by others.

Motors shall be set in place by others and the associated motor starters, controllers, and disconnects shall be turned over for installation.

Control wiring, regardless of voltage, shall be the responsibility of the division providing the motor unless specifically indicated otherwise on the electrical drawings.

Furnish and size the overload protection as required for the motor load.

Thoroughly investigate the equipment connection schedules and other portions of the contract drawings to determine the extent of work required for connections to equipment furnished by others.

The National Electric code requires that a duplex receptacle be installed on the roof any time there is roof mounted equipment installed.
Provide a heavy-duty weatherproof ground fault receptacle on the roof near the roof mounted air conditioning, refrigeration, and heating equipment.

The outlet box shall be an FS cast iron type.

This receptacle may be attached to an equipment supporting leg or other similar apparatus on the roof, or if none is available, shall be supported using a supporting framework.

The receptacle feed conduits shall be stubbed through the roof using a weatherproof boot.

This receptacle shall be connected to the nearest available panel and connected to a 20 amp circuit breaker unless shown otherwise on plans.

This receptacle shall be furnished whether or not it is explicitly shown on the drawings.

Provide duct smoke detectors where called out on the plans.

Coordinate the installation of the duct detectors with Division 23.

The duct detectors are connected to shut down the air handling unit.

Work with Division 23 to be certain that the proper interface connections are provided in the temperature control panel or the air handler starter, to make the connection for the shutdown.

Mark the temperature control panel or the roof top unit starter with a permanently engraved label that states: "This unit is connected to automatically shut down with fire alarm system."

Final Testing:

Prior to energizing any equipment whether installed by this section or not:

First make a thorough inspection of it to make sure it has been unpacked correctly and all packing materials and supports have been removed.

Be responsible for assisting the equipment start up personnel to assure correct equipment connections and rotation.
APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
Conform to requirements of ANSI/NFPA 70 - National Electric Code.
Conform to current Underwriters Laboratories (UL) Specifications and Standards.
Device specific standards and requirements are included in device specifications.

DESCRIPTION OF WORK
Provide and install wiring devices as required on the drawings and as specified herein.

RELATED WORK ELSEWHERE
Division 26, 27, and 28: Electrical

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.
The following information shall be submitted in addition to items listed above:
One sample of each switch will be supplied to Electrical Engineer, for review prior to installation.
One sample of each receptacle will be supplied to Electrical Engineer for review prior to installation.

OPERATION & MAINTENANCE MANUALS
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.
All materials, equipment and parts shall be new and unused of current manufacture.
Provide all necessary accessories required for a complete and operable system.
Store wiring devices and accessories in original cartons and in clean dry space; protect from weather and construction traffic.

WARRANTY
Equipment shall be warranted for a period of not less than 2 years from the date of commissioning against defects in material and workmanship.
The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.
The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.
PART 2 - PRODUCTS

GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

WALL SWITCHES
Switches shall be:
UL listed for current and voltages indicated.
Shall comply with NEMA standard publication WD-1, “Heavy Duty Wiring Devices”.
Federal Specifications Test WS-896 E.
UL standard 20, 943 class A (GFCI) and 498.
Switches shall be 20 ampere heavy duty specification grade unless noted.
Switches shall have provisions for back and side wiring, screw clamp type suitable for solid or stranded wire with separate green ground screw.
Switches shall be ivory unless noted.
Switches shall be made of nylon or high impact resistant material.
Modular switches with pigtailed terminals are allowed.
Supply the following:
Wall switch with:
20 ampere, 120/277 volt rating.
Toggle handle.
Single-pole, double-pole, 3-way and 4-way switches shall be available.
Approved vendors are: Cooper, Hubbell Wiring, Leviton, and Pass & Seymour.

LED slide dimmer
Appropriate for specified dimming LED driver.
Push button on/off with indicator light.
Preset levels may be maintained by use of On/Off push button
Power leads may be integral.
Solid state circuitry.
Heat sink.
Surge protection, 6000V, 200A.
Electrostatic discharge protection up to 16,000V.
Power failure memory.
Face plate.
Dimmer shall not require a minimum load.
Color to match other wiring devices.
Available in single-pole and 3-way.
Provide appropriate dimmer to all for operation with motion sensor, photo sensor and emergency bypass switch as shown on plans. Switch manufacturer to be same manufacturer as other devices.
Provide separate switch box for all low voltage 0-10V dimmers.
RECEPTACLES

Receptacles shall be:

- UL listed for current, uses and voltages indicated.

- Shall comply with NEMA standard publication WD-1 and WD-6 standards.

Receptacles shall be specification grade unless noted.

Receptacles (with the exception of GFCI) shall have one piece brass strap.

Receptacles shall have provisions for back and side wiring, screw clamp type suitable for solid or stranded wire with separate green ground screw.

Receptacles shall be ivory unless noted.

Modular receptacles with pigtailed terminals are allowed.

Receptacles shall be made of nylon or high impact resistant material.

Receptacles installed in wet or damp locations shall be weather resistant.

Receptacles shall be supplied with face plate.

Supply the following:

- Duplex NEMA 5-20R heavy duty straight blade receptacles with:
  - 20 ampere, 120 volt rating.
  - Standard face shape.
  - 2-pole, 3-wire grounding
  - Approved vendors are: Cooper, Hubbell Wiring, Leviton, and Pass & Seymour.

- GFCI Duplex NEMA 5-20R receptacles with:
  - 20 ampere, 125 volt rating.
  - Standard GFCI face.
  - GFCI compatible face plate.
  - 2-pole, 3-wire grounding.
  - Approved vendors are: Cooper, Hubbell Wiring, Leviton, Pass & Seymour.

PLATE COVERS

All plate covers shall be ivory (unless noted) smooth lexan or nylon.

Cast metal plates: Die cast profile, ribbed for strength, flash removed, primed with gray enamel, furnished complete with four mounting screws.

Steel plates: Hot dip galvanized 1.25 oz /sq. ft. minimum.

Weatherproof receptacle plate shall be heavy duty type, cast aluminum with a deep cover hood to provide weatherproof protection while an attachment plug cap is inserted. Plate shall be code approved as “suitable for wet locations while in use”. Weatherproof cover shall be provided with ¼”padlock hole. Plate must meet OSHA lockout/tagout requirements. Provide a padlock for each weatherproof receptacle cover installed on the project. All padlocks shall be keyed alike. Provide twenty spare keys for Owner’s use.

Surface box plates: Beveled, steel, pressure formed for smooth edge to fit box.

Where two-gang boxes are required for single gang devices, provide special plates with device opening in one gang and second gang blank.
Approved vendors are: Cooper, Hubbell Wiring, Leviton, and Pass & Seymour.

**PART 3 - EXECUTION**

**EXAMINATION**
Verify outlet boxes are installed at proper height.
Verify wall openings are neatly cut and will be completely covered by wall plates.
Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
Inspect each wiring device for defects.
Operate each wall switch with circuit energized and verify proper operation.
Verify that each receptacle device is energized.
Test each receptacle device for proper polarity.
Test each GFCI receptacle device for proper operation.
Test that each receptacle is properly grounded.
Adjust devices and wall plates to be flush and level.

**FIELD MEASUREMENTS**
Field verify proper location of all wiring devices with field conditions and adjust accordingly.

**DELIVERY, STORAGE AND HANDLING**
Receive, sign for and store all equipment in this section.
Maintain original quality and condition of equipment while it is in storage.

**INSTALLATION**
General:
The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.
Install all materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.
Start of installation shall not begin until areas are broom clean, properly lighted, exterior enclosing walls in place, exterior windows glazed, roof completely installed to prevent weather damage to equipment.
Install products in accordance with manufacturer's instructions.
Install devices plumb and level.
Install switches with OFF position down.
Install vertical receptacles with grounding pole on top and horizontal receptacles with grounding pole to left.
Connect wiring device grounding terminal to outlet box with bonding jumper.

Install decorative plates on switch, receptacle, and blank outlets in finished areas.

Connect wiring devices by wrapping solid conductor around screw terminal, or inserting into wire clamp. Wrapping conductor not allowed for stranded wire.

Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

Mount switches at heights shown in specification 26 05 37 unless otherwise noted. Coordinate location with architectural detail.

In areas where ceiling mounted receptacles and outlets are shown, the face of the receptacle or outlet is to be flush with the ceiling finish. For grid ceilings, provide proper support framing such that receptacles and outlets can be used from the ceiling below without damaging the ceiling tile.

Preparation:
   - Provide extension rings to bring outlet boxes flush with finished surface.
   - Clean debris from outlet boxes.

**OWNER TRAINING (NONE)**

**SPARE EQUIPMENT**

Provide five duplex receptacles.

Provide five light switches.

* * * * * *
SECTION 26 27 28
CIRCUIT & MOTOR DISCONNECTS

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1
specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
Conform to current National Electrical Manufactures Association (NEMA) Standards.
Conform to current Underwriters Laboratories (UL) Specifications and Standards.

DESCRIPTION OF WORK
Furnish and install heavy-duty fusible type disconnect switches of types scheduled at locations shown on the
drawings and as specified herein. See HVAC plans for additional disconnects required by this contractor.
Furnish and install other disconnect switches as necessary and required with proper number of poles, voltage and
enclosure type ratings as required for the application and as required by the National Electrical Code.
Provide proper environmental enclosure for disconnect depending on the mounting location.
Provide fused or non-fused disconnect as required for proper protection of the equipment.
Provide all code required disconnects. Assume responsibility for reviewing equipment connections and starting
equipment provided with the equipment and determining if disconnects are required.
For fused disconnects, provide appropriately sized fuses for the equipment.
Install and wire mechanical system starters. See other portions of specifications indicating requirements for work.

RELATED WORK ELSEWHERE
Division 26: Electrical

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.

OPERATION & MAINTENANCE MANUALS
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.

All materials, equipment and parts are to be new, undamaged and unused of current Manufacture.

WARRANTY
Equipment shall be warranted for a period of not less than 2 years from the date of commissioning against defects in
material and workmanship.
The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts
cost, etc.
The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

GENERAL
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

DISCONNECTS
Disconnect switches shall be heavy duty switch operated type with cover interlock and enclosed arc chamber, quick make and quick break and provision for padlocking in either the open or closed position. All heavy duty, safety switches 30 to 600A, shall be provided with Class R rejection style fuse clips. The combination rating of the heavy-duty switch and R fuse shall be 200,000 symmetrical amps and labeled as such.

Disconnects shall be NEMA 3R rated for all outdoor applications.

Approved manufacturers: Square D, Cutler Hammer.

PART 3 - EXECUTION

EXAMINATION
Verify equipment is in compliance with approved submittal drawings.

FIELD MEASUREMENTS
Field verify locations of disconnects with other trades. Adjust as required to meet field conditions and code requirements.

DELIVERY, STORAGE AND HANDLING
Receive, sign for and store all equipment in this section.

Maintain original quality and condition of equipment while it is in storage.

INSTALLATION
General:
The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.

Install all materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

Mount per Section 26 05 29.

Cleaning:
Prior to turning the system over to the Owner, the system shall be physically cleaned.

All appearance defects shall be carefully and professionally touched up so that the equipment is in “factory new” condition.
At the completion of the work, remove from the building and the premises all rubbish and debris resulting from the work.

SPARE EQUIPMENT
Provide (1) set of spare fuses for each fusible disconnect provided.

* * * * *
SECTION 26 51 13
INTERIOR LIGHTING FIXTURES

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions, apply to work of this section.

APPLICABLE PUBLICATIONS
Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
Conform to current Underwriters Laboratories (UL) Specifications and Standards.
Conform to Wisconsin Administrative Code, Comm. 63.
Conform to American National Standards Institute ANSI C 82.11-1993
Conform to current National Electrical Manufactures Association Standards.

DESCRIPTION OF WORK
Furnish and install a complete interior lighting system as required on the drawings and as specified herein.

RELATED WORK ELSEWHERE
Division 26: Electrical

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.
The following information shall be submitted in addition to items listed above:
   Submit color samples as requested.
   Fixtures specified as “RAL color to be determined” shall:
      Include one RAL color swatchbook equal to PPG ENVIRPCRON Powder coatings Classic RAL
      Color Deck with submittals.

OPERATION & MAINTENANCE MANUALS
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.
All materials, equipment and parts shall be new and unused of current manufacture.
Provide all necessary accessories required for a complete and operable system.
Install lamps and test fixtures for proper operation, and make all ready for use by Owner.

WARRANTY
Lighting fixtures shall be warranted for a period of not less than 2 years from the date of commissioning against defects in material and workmanship.
The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, and repair parts cost.

The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

**PART 2 - PRODUCTS**

**GENERAL**
All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

**FIXTURES AND COMPONENTS**
Each bidder shall make his own count of all fixtures of the types indicated on the fixture schedule and they shall be furnished as outlined hereunder.

Basic catalog number only is given herein for fixtures; plaster rings, fixture ends or caps, suspension units, furnish mounting brackets and/or all other auxiliary parts necessary for a complete installation. Fixture shall be furnished as required, for a full and complete installation, even though not specifically called out on plans.

Should any parts of the fixtures be found to be bent or not in accord with their designed position, adjust, repair or replace at once the affected items required.

**FIXTURE LAMPS**
All fixtures that are LED will have the LED’s included with the fixture.

**PART 3 - EXECUTION**

**FIELD MEASUREMENTS**
Verify that field measurements are as shown on drawings.

**DELIVERY, STORAGE AND HANDLING**
Receive, sign for, and store all equipment in this section. Maintain original quality and condition of equipment while it is in storage.

**INSTALLATION**
General:
The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.

Install all materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

Start of installation shall not begin until areas are broom clean, properly lighted, exterior enclosing walls in place, exterior windows glazed, roof completely installed to prevent weather damage to equipment.

Check and confirm ceiling material, recessing space and suspension system with Construction Manager before releasing the order for any recessed fixtures.

Type of ceiling material and suspension system must be submitted with fixture order to ensure delivery of proper fixtures.
Approval of fixture drawings by the Electrical Engineer shall not relieve this section from responsibility of ceiling confirmation.

Clean electrical parts to remove conductive and deleterious materials.

Remove dirt and debris from enclosure.

Clean photometric control surfaces as recommended by manufacturer.

Clean finishes and replace damaged equipment.

All fixtures to be supported from structural system, not from ceiling material.

All fixtures to be supported at minimum of 4 feet-0 inches on center.

All tees supporting fixtures to be secured directly to the structural system.

Intermediate tees shall not be used for mounting fixtures.

If fixtures occur between structural tees, fixture supports shall be installed by spanning structural tees from above, or by suspending a channel support above ceiling from building structure.

Recessed lay-in and non-recessed grid mounted lighting fixtures:

Where lay-in light fixtures are provided, the fixture shall be securely fastened to the ceiling framing members by mechanical means; such as bolts, screws, or rivet clips identified for use with the type of ceiling framing members and fixtures being used.

Grid mounted fixtures shall be mounted in the grid and attached to the grid system per NEC.

Separate mounting shall be provided to the ceiling structure above.

Provide a minimum of two supports per fixture per NEC.

Pendant suspended luminaires:

All stem mounted luminaires shall be suspended with swivel hangers.

Install suspended luminaires using pendants/stems supported from swivel hangers.

Provide pendant/stem length required to suspend luminaire at indicated height.

Aircraft cable suspended luminaires

All aircraft cable luminaires to be suspended with swivel hangers.

Install aircraft cable suspended luminaires using aircraft cable supported from swivel hangers.

Provide aircraft cable length required to suspend luminaire at indicated height.

Recessed luminaries:

Locate recessed ceiling luminaires as indicated on ceiling plan.

Relocate light fixtures as necessary and coordinate with other mechanical trades.

Coordinate installation in the field, where necessary.
Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

Install clips to secure recessed grid-supported luminaires in place and separate support wires for each fixture.

Where recessed fixtures occur in tile ceiling, notify the ceiling contractor so fixture and tile arrangements can be coordinated.

Install recessed luminaires to permit removal from below.

Surface mounted luminaries:
Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

Lighting fixtures installed in areas where there are not suspended ceilings:
In areas where lighting fixtures are installed where there are not suspended ceilings furnish all mounting hardware.

Continuous fixtures:
In areas where lighting fixtures are mounted end-to-end in ceiling joist area, furnish support strut to solidly support the fixtures.

Support strut may be B-line, Kindorf or equal.

Strut shall be supported 8' on center using pendant hangers with swivels mounted on 4" square boxes.

Mounting hardware painting:
Mounting hardware to be installed prior to the ceiling being painted.

If it is not installed prior to that time, paint the support hardware.

Special color requirements:
Refer to fixture schedule to determine if there are special color requirements for the mounting hardware and lighting fixtures other than the ceiling finish.

Clearance heights:
Lighting fixtures shall be mounted to maintain maximum head clearance height and that the bottom of the fixtures shall be even with the bottom of the ceiling joists.

Mounting locations:
The fixtures shall be mounted between the joists unless otherwise shown on the floor plans.

If fixtures are mounted perpendicular to joist, attach fixtures to the bottom of the joist and furnish steel support struts to the bottom of the joists for fixture support.

Individual fixtures:
In the ceiling joist area, individual fixtures shall be supported using pendant hangers with swivels mounted on 4" square boxes.

Fixtures shall be fed through one pendant end.
Flat ceiling spaces:

The fixtures shall be mounted tight to the ceiling unless it is required to adjust the fixture height because of mechanical equipment interference.

If required to adjust the fixture height because of mechanical equipment interference, support the fixtures using pendant hangers.

Wire Guards:

Furnish wire guards for all open strip or industrial fixtures.

Mechanical Rooms:

The light fixtures in the mechanical rooms are shown to indicate number of fixtures only.

Locate the lighting fixtures to coordinate with the mechanical equipment installation.

If required, these fixtures may be supported using chain with a cord connection.

If fixture cannot be mounted on the ceiling, lighting fixture shall be mounted on the wall using an adjustable wall bracket.

Install accessories furnished with each luminaire.

Connect luminaires using flexible conduit.

Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

Bond products and metal accessories to branch circuit equipment grounding conductor

Fixtures not to be used as a raceway.

Cleaning:

Prior to turning the system over to the Owner, the system shall be physically cleaned.

All appearance defects shall be carefully and professionally touched up so that the equipment is in “factory new” condition.

At the completion of the work, remove from the building and the premises all rubbish and debris resulting from the work.

Final Testing:

Operate each luminaire after installation.

Confirm codes are met regarding daylighting and dual level controls.

Confirm light controls properly operate intended fixtures.

OWNER TRAINING

Provide minimum of one hour training on luminaire operation and lamp replacement.

* * * * *
APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions, apply to work of this section.

APPLICABLE PUBLICATIONS
TIA/EIA 568-B.1 – Commercial Building Telecommunications Cabling Standard, Part 1: General requirements.
TIA/EIA-569-A - Commercial Building Standards for Telecommunications Pathways and Spaces.
TIA/EIA-606 - Documentation.
TIA/EIA-607 - Commercial Building Bonding and Grounding Requirements.

Definitions:
MC: Main Communications Closet.
TC: Telecommunications Communications Closet.
MDF: Main Distribution Frame - this term is used interchangeably with MC.
IDF: Intermediate Distribution Frame - this term is used interchangeably with TC.
Wireless Access Point(WAP): The outlet point for wireless LAN connection
Backboard (normally called a backplane): A panel, wood or metal, used to mount termination hardware, on the wall that is adjacent to the relay rack. The plywood used for the backboard shall be fire rated ¾” plywood, painted off white.
Backbone Cable: A facility installed between different distribution points for the purpose of connecting system distribution points.
Back/Outlet Box: This box is used for terminating outlets.
Cable Labeling System: The printed labeling system that allows labeling of each telecommunications room (TR), all relay racks, patch panels, backbone and horizontal cables (this includes the grounding bus throughout the facility) and conduit runs.
Cable Tray: A mechanism that allows cable to be managed.
Conduit Run: Multiple sections of conduit placed to run cables inside. Typically a conduit run is when you cannot see the other end from the beginning.
Conduit Stub: A section of conduit place to run cables up (vertically) to an exposed cable route in the ceiling area. The conduit stubs sometimes run down through the floor to the ceiling area below or to a floor jack.
Contractor, Electrical (EC): The contractor that is awarded the bid or contract for described work in Division 26.

Cross-Connect: A facility enabling termination of cables and their inter-connection.

Exposed: This is any location that can be seen from an occupied space when the project is complete. The exceptions will be noted in this specification.

Entrance Facility: This area provides the entrance point for the communication services that enter the facility from the AP or the cable service provider. Lightning protection shall be installed, unless otherwise noted. This is where the outside cable type shall convert to inside cabling, unless otherwise noted. The outside cabling can be extended to the equipment room in metal conduit. It is recommended, however not required, that the lightning protection be installed as soon as the cable enters the building. The entrance facility may be shared with other services. The lightning protection shall be grounded to the building main ground (this can be done by attaching to the TMGB).

Firestop: Specialty material to re-establish a fire rated barrier. The material used is either cementitious or elastomeric.

Ground Busbar: The bar that is installed to attach the grounding conductors to. The one that is attached to the grounding electrode via a bonding conductor, typically located in the electrical switch room. Then a TBB is attached to the TMGB and allows all of the TGB’s to be grounded. The one that is installed in all of the TR’s is a telecommunications busbar (TGB).

Ground Conductor(s): The conductor that provides ground to the main grounding system, at the electrical panels is called the bonding conductor (BC). The conductor that connects the telecommunications room (TR’s) back to the telecommunication main grounding bus (TMGB) is called the telecommunication bonding backbone (TBB). The grounding backbone between the TR’s is called the telecommunication bonding backbone interconnecting bonding conductor (TBBIBC).

Horizontal Cabling: The cable used to carry the information from the workstation or end device to the least significant distribution point. For the voice and data this will be the telecommunications room. The paging, security, and CATV will be where distribution points are; normally this is in the equipment room or telecommunications room or equipment room.

Installer: Contractor installing the low voltage structured cabling and associated hardware.

J-Box: the boxes used to limit or extend distances within a conduit run or horizontal raceways. This box will be required to have the appropriate blank covers installed. The size is determined by the application and the guidelines in the TIA/EIA cabling standards.

J-Hook: A support device that is attached to the building structure and used to support structure cabling. The device is shaped like a J and the cables are laid in the open section of the J. There will be a retainer installed on all j-hooks.

Pathway: A vertical and horizontal path, used to place telecommunication cable inside of it.

Plenum: A compartment or chamber that is used as part of the air distribution system and is connected with one or more air ducts. Due to the airflow through this chamber, the cable and other materials used in this chamber are required to have a higher fire rating. Typically this airflow is the return airflow path.

Power Pole: A raceway that provides a path from the ceiling to the furniture or floor. This pole might be dedicated or shared between the low voltage and the electrical services. If the access pole is a dedicated pole for communication cables, it is sometimes referred to as a communication pole.
Pull Cord/Wire: Cord placed in a cable path to pull wire through that same path.

RCDD: Registered Communication Distribution Designer. A certification provided by BICSI to individuals that have met criteria via education and testing to be certified to design telecommunication systems.

Service Cable Path: The service cable path is a route that allows a minimum of 12’ of spare cable provided at the distribution point for the purpose of having spare cable for servicing the structure. This cable will be managed by support hardware as designated by the drawings provided. (There shall not be any service cable left at the station end other than the 12’ left after the cable is terminated.)

Station Outlet: A device placed at the end of the horizontal cable to terminate the horizontal cable and connect the network equipment in the work area.

Telecommunications Contractor (TC): The contractor that is awarded the bid or contract for this work will include all the work as described in this specification, excluding the EC specified work.

Telecommunications Utility: The telecommunications utility will bring their services into the equipment room as designated on the floor plans.

Testing: Qualifying the cable for the necessary parameters described. The testing requires electronic and hardcopy of the test results. Sometimes referred to as Acceptance Testing.

Work Area Outlet: A device placed at the end of the horizontal cable to terminate the horizontal cable and connect the network equipment in the work area.

DESCRIPTION OF WORK: DATA

Install new cat 6 data cabling routed to existing data rack in gym wing where shown on plans. Verify best routing on site to existing rack prior to bid. Provide new D rings for support and additional conduit thru walls where required. Provide additional patch panels in existing rack.

Furnish and install a complete and operable data and fiber cabling system as indicated on the drawings and as specified herein.

Mount and connect District furnished WAPs in locations as indicated on plans as “WAP”. Furnish and install data cables to this location and coil 15’ service loop at structure supported with D ring. Mounting hardware to be supplied by owner. Assume all data outlets shown with WAP on drawings will require a WAP to be mounted.

Coordinate with District which locations will have WAPs installed and which locations will be for future WAPs.

Provide male end on all WAP device outlets shown at WAP location and terminate end in data closet on standard patch panel. Coordinate WAP IP addresses prior to installation with district.

Division 26 contractor to include all division 27 work in his bid.

Provide data cabling, patch panels, devices, termination and testing for entry system per plans.

RELATED WORK ELSEWHERE

Division 26: Electrical

SHOP DRAWINGS

Submit shop drawings in accordance with Division 1 Specification Sections
The following information shall be submitted in addition to items listed above:

Complete riser diagram indicating all equipment and interconnecting components with indication of location of each device.

Complete front elevation drawing of equipment rack and exact component layout within rack.

All drawings must be in CADD format.

Cable listing for each cable installed. Indicate in spreadsheet format showing room location, head-end location, and exact labeling. Provide on each end of each outlet.

Reduced size floor plan drawing (11" x 17"), showing building floor plan and location of all data outlets. Each of the rooms shall be numbered and the approximate location of each data outlet shall be shown. Prior to beginning that, determine if the owner has an existing number plan sequence in place, and if so, he shall use that numbering system for this project. Include such numbering system on his submittal data. Determine the numbering method for each of the outlets. As an example; a typical space which consists of five data outlets, the suggested format is to assign a cable number (1, 2, 3, 4, etc.) for each of the data outlets or a letter (A, B, C, D, etc.).

As a part of the shop drawing documentation, cable numbers, data outlet numbers, and patch panel jack numbers must be assigned and shown.

OPERATION & MAINTENANCE MANUALS
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

The following information shall be submitted in addition to the items listed above:

Complete riser diagram indicating all equipment and interconnecting components with indication of location of each device.

Complete front elevation drawing of equipment rack and exact component layout within rack.

Provide copy of written warranty.

Complete test report for all cabling. Provide test form which includes the following:

Date and time of:

- Cable installation.
- Cable termination.
- Testing report.

Testing equipment used information including:

- Make.
- Model.
- Date of calibration.

Name of person performing test and the installers.

All cable shall be tested to comply with the standards that are set forth in EIA/TIA TSB 67: Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems. It is assumed that testing will be done for the basic length of installed horizontal cable 90', length.
At each pair of each horizontal feeder cable shall test free of shorts within the pairs. Each pair shall be tested. Cable length, in feet, shall be tested within 4% of accuracy. All testing shall be done using a cable testing unit that complies with the standards as set forth in TSB 67.

QUALITY ASSURANCE

Provide quality assurance in accordance with Section 26 05 04.

Ensure all cables are less than 300 feet in length. Install cables in the shortest possible manner to ensure less than 300 feet is maintained in spaces where distances are exceeded routing cable in tray. In this case provide D rings for cable support to cable tray.

A single contractor, who has at least five (5) year experience in furnishing similar data, voice, and systems, shall supply all specified equipment and services.

Contractor shall employ a project manager for this project who has completed five (5) projects (similar in size) in the last 5 years and holds an active RCDD status. Credentials shall be available to the Engineer upon request.

WARRANTY

The data cabling system and labor for installation shall be provided with a minimum 10-year warranty from the cable manufacturer. This warranty shall cover material and workmanship.

The cable installed shall be a certified integrator, and shall provide cable manufacturer certified outlet components, such that the entire system is certified for the 10-year warranty. Provide a letter of verification as a part of the submittal drawings indicating that the warranty will be provided. Failure to provide this letter will cause submittal to be rejected and will require resubmittal.

The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, and repair parts cost.

Submit a written warranty executed by the installer agreeing to repair or replace any cabling that fails within the warranty period.

During the guarantee period there shall be no charges to the Owner for service calls for guarantee work. However, when service work is required to repair items damaged by neglect, misuse, or vandalism, costs shall be reimbursed to this Contractor.

The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

UTP DATA CABLE

Outlet cables: All data cable shall be:

Category 6

4-pair.

All cable to be Plenum rated.

Blue cable for standard data drops

Orange cable for WAP location
Associated jacks to match cable color

WORK STATION COMMUNICATION OUTLETS - WALL MOUNTED

See floor plans for communication connector types to be included at each work station communication outlet location.

Each communication outlet shall consist of:

- 4” square, 2 1/8” deep outlet box.
- Single gang ring.
- 1” conduit minimum stubbed into ceiling space, either stubbed into room, or if cable tray is provided, stubbed toward cable tray. If cable tray is not provided, stub toward corridor. Provide insulated connector on each end. Size conduit for quantity of cables shown.
- Communication outlet plate angled type to allow for Cat6A cabling bending radius.

In those areas where devices are mounted on existing walls, provide an equivalent surface raceway system. Use Wiremold or Hubbell deep outlet box and surface metallic raceway.

Provide wall mount face plates, combination type. Face plate to include the following:

- 4-position openings for keystone type outlets; if more than 4 devices are shown at a location, provide 6-position openings for keystone type outlets.
- Label holders.
- Typed overlay label affixed above each outlet position indicating the outlet number.

All empty openings shall be closed.

Provide the appropriate communications device in the opening as shown on the floor plans. Data outlets 568B, RJ45 configuration, angled-type.

Orange: data

Data outlets shall be power sum rated.

Outlets shall meet the following minimum requirements:

- Power sum next @ 100 Mhz = 40 dB.
- Next @ 100 Mhz = 42 dB.
- Attenuation @ 100 Mhz = .4 dB.
- Return loss @ 100 Mhz = 18 dB.

Wall phone mounting plates:

- Stainless steel with two mounting studs.
- 8-position 110 IDC.
DATA JUMPER CABLES
Provide (1) 48” category 6 jumper cable for each data outlet, CCTV, Keyless entry and WAP shown on power plans for the District’s use for connecting between patch panel and switches. Color to match cabling color listed.

WIRE MANAGEMENT PANELS
Horizontal, front and back: to coordinate with rack provided.
Vertical mounted, front and back: to coordinate with rack provided.

PATCH PANELS
Patch panel shall be as follows. All patch panels shall be power sum rated and tested in a link configuration. Devices shall have same rating as station outlets.

   Category 6
   48 jack high density assembly.
   Each jack shall have an associated “type-on” label for marking and shall be marked.
   Each patch panel shall have associated with it, a rear mounted and front mounted metal wire manager unit.
   Each patch panel shall be identified with an engraved nameplate. Plate shall be designated as: “Data Distribution Patch Panel #1”.

RACKS, LADDER TRAY AND ACCESSORIES
Type  Fully enclosed, dial hinged, vented, solid front door, wall rack
   CPI 19”x36”
   Or equal
   Plug strip:
      Trip Lite DRS -1215 rack mounted. Or equal

J HOOKS
Data cable supports:
   Caddy Cable type

PLYWOOD BACKBOARD
Provide 4 x 8 fire resistant painted plywood, AC grade, good one side, where shown on walls. Paint plywood white with fireproof paint. Provide cutout for flush receptacles. Furnish and install extension rings.

DATA EQUIPMENT LABELS
See specification section 26 05 53 for label materials.

PART 3 - EXECUTION

EXAMINATION
Verify surfaces and areas are ready to receive work.
Verify field measurements are accurate and shown on drawings.
Verify proper power connections are installed.
Proceed with installation only after unsatisfactory conditions are corrected.
All wiring shall test free from grounds and shorts.

**FIELD MEASUREMENTS**
Field verify exact location for all floor and wall racks and all floor mounted equipment.

**DELIVERY, STORAGE & HANDLING**
Receive, sign for, and store all equipment in this section.
Maintain original quality and condition of equipment while it is in storage.

**INSTALLATION**
All data jacks to be labeled at device location and origination within 3” of end of cable. Provide additional labeling at 3’, 6’ and 9’ after tagged cable ends at 3”. The additional marking at 3’, 6’ and 9’ can be done with permanent marker.
Install all low voltage cabling after painting or protect cabling from paint.
Neatly train all data cabling in cable trays where possible.
Provide complete testing and documentation as listed.

**General:**
The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.
Install all materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

**Cleaning:**
Prior to turning the system over to the Owner, the system shall be physically cleaned.
All appearance defects shall be carefully and professionally touched up so that the equipment is in “factory new” condition.
At the completion of the work, remove from the building and the premises all rubbish and debris resulting from the work.

**Raceways:**
All 120 volt wiring shall be in a conduit system separate from other building wiring.
All 120 volt wiring shall be in minimum ¾” steel raceway. Below floors to be rigid steel conduit.
There shall be no sharp edges with installed materials.

**Cable:**
Cable type, size, and quantity to be as shown on drawings. Vendor to verify exact cable required based on the equipment and provide appropriate cable.
All wire runs shall be continuous lengths, without splices.
All wiring systems shall be color coded as shown on the drawings. Green conductors shall be used only for grounding conductors, white only for neutral conductors and black shall be reserved for 120-volt line.
Marker strips shall be attached to the field wiring. These markers shall not change when devices are replaced during repair or maintenance.

Within equipment cabinets, all wires and cables shall be contained in wire management channels such as Panduit or equal, and dressed and labeled in such a manner that all wires may be easily traced, and such that they do not obstruct access to components which may need to be replaced or serviced.

All low voltage cabling to be routed in Caddy clips or in cable tray.

All cabling to be color coded for phase.

Grounding:

All equipment shall be grounded in accordance with NEC, these specifications and drawings, and the equipment supplier’s recommendations.

Each cabinet frame shall be grounded.

All exterior panels of cabinets shall be bonded to the cabinet frame.

All equipment installed in a cabinet shall be bonded to the cabinet frame.

Final Testing:

The completed data system shall be fully tested by the Contractor. Upon completion of a successful test, certify in writing to the Owner.

Conduit stubs: In areas where ceilings are unfinished or ceilings are inaccessible by either height or for other reasons, the conduit stubs shall be extended to a further location to an accessible area. Provide conduit stubs thru walls and where required. No wiring to pass thru a wall without a conduit stub.

Numbering and labeling:

All communication outlets shall be provided with an overlay label indicating the outlet number. This shall be provided for all devices mounted in the communications faceplate.

Data and Voice cables – UTP:

Shall be installed in raceways and cable trays where applicable.

Where cable is run in the open, it shall meet the following criteria:

Routed through "J-hook" Caddy CAT32 or equal. Route all new cabling in new J-hooks unless specifically indicated by owner that existing can be reused. This must be done on site prior to installation. All new J-Hook locations and routing must be verified by district electrician prior to installation.

Maintain at least a 12” separation from fluorescent or neon lighting fixtures.

Maintain at least a 3.3’ separation from transformers, motor or other sources of electromagnetic fields.

Maintain the following separation from unshielded power cables - 36”.

Do not route within 50’ of arc welders.

Cable Termination:

All cable conductors shall be terminated per EIA/TIA cable terminating standards as recommended by the manufacturer of the data system.
Cable Support & Raceways:

In areas where there are not accessible ceilings, cables shall be installed in surface mounted, metallic raceway as specified in specification section 26 05 34. Provide all ceiling raceways where multiple cables are run with a minimum of 50% additional space to allow for future cables to be added. If surface raceway size is shown on drawings, provide that size or larger or multiples of the size shown as required.

Above accessible ceilings, a "J-hook" support system shall be used throughout the ceiling space. The "J" hooks shall have flat bottom to eliminate single point stress on cables supported. Min size is cat 32. Allow for 50% spare capacity in all runs of J hooks. Provide additional runs where required to meet this requirement. Cables shall not be installed in a hap-hazard manner across the ceiling grid system. J-hooks to be separate from the security or fire alarm J hooks. J hook spacing to be a maximum of 5’ on center. J hooks to be run parallel to the security and fire alarm J hooks. The following method shall be used:

Conduits that are stubbed into the accessible ceiling space that are acting as cable raceways shall be extended into the nearest corridor space, or, as an option, install a sleeve through any wall separating the room from the corridor area.

Cables shall be routed at 90 degrees from the room to the J-hook support system in the corridor. The corridor area shall generally be defined as the area where the J-hook support system shall be installed. However, in the event that there is not adequate corridor space, the J-hook system may be moved into the adjacent rooms.

J-hook system shall be installed in straight lines perpendicular, right angle to the building walls. Groups of J-hooks shall be used where the single J-hook system is not adequate to support the cabling.

The support system shall be used up to the conduits that feed the cables into the outlet or cable distribution points. Mark the record drawings to indicate the approximate path of the support system.

Mark the "record drawings" to indicate the approximate path of the J-hook system.

Provide and install all wall sleeves and penetrations. Any place that a wall is penetrated to route cable through the wall, the contractor shall provide a through-the-wall sleeve. Shall be steel conduit with insulated connectors on ends must be used. Assume that for each door entering each room, to include in pricing, the cost of providing and installing one sleeve above all doors entering rooms. These sleeves shall be installed above the ceiling grid.

In those areas where there is not an existing ceiling, all system cables shall be routed through conduit, through the non-ceiling area, into an area where there is ceiling cavity. There shall be no open cables routed through ceiling areas, unless it is indicated otherwise on the drawings.

Cable Labeling Scheme:

The Owner has implemented an existing data cabling and patchpanel outlet labeling scheme which the contractor will be required to follow for this project.

The scheme labels the cable and outlet numbers based on the telecommunications closet location, patchpanel location within that rack, and the outlet number on that patchpanel. The contractor will be required to meet with the owner’s telecommunications facility coordinator prior to providing data cabling. For this project the contractor will be required to determine that prior to equipment and cable listing submittal, and from that information, provide the appropriate label numbers on the submittal documents. This submittal will be required prior to installation.

Contractor must coordinate with Jon Knickelbein, District Electrician on labeling of all data cabling, jacks, patch panels, circuits, panels and transformers prior to installation.
Data Rack/Cabinet Installation:

- Racks and enclosures shall be bolted to wall

- Racks shall be bonded to grounding system.

- Racks shall be bonded to each other using a flexible bonding strap bolted to enclosure/rack.

Patch Panel Installation:

- Incoming cables from jack panels shall be installed and connected such that the incoming cables are grouped by rooms, spaces, and departments. It will be the contractor or his supplier’s responsibility to initially meet with the Owner to determine what the requested groupings are.

- The submittal drawings for the data system shall include front elevations of all patch panels should be shown with a number that will be associated with each patch panel jack. See system documentation for additional requirements. There shall be a listing indicating which jack is connected to which outlet; i.e. room space or department.

- Incoming cables to jack panels shall be neatly trained in vertical wire management system prior to final termination.

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SECTION 27 30 00
TWO-WAY COMMUNICATION SYSTEM

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions apply to work of this section.

APPLICABLE PUBLICATIONS
Conform to requirements of current ANSI/NFPA 70 – National Electric Code.
Conform to current Underwriters Laboratories (UL) Specifications and Standards.
Conform to current Telecommunication Industry Association (TIA/EIA).
Conform to current National Electrical Manufacturers Associates (NEMA) Standards.
UL Listing - All material and equipment shall be listed, labeled, or certified by Underwriters Laboratories, Inc. The intercom/paging system shall be UL 813 listed as a complete system. All power supplies and computers shall be UL listed. Provide UL listing cards for all components specified herein.
Conform to requirements of current ADAAG, IBC and NFPA

DESCRIPTION OF WORK
The electrical contractor shall furnish an additional station added to the existing two-way area of refuge system. The annunciator is located in the main vestibule entry near the main office area. Product of a single manufacturer and shall be manufactured by Cornell Communications, Inc.; 800-558-8957. Provide all new equipment required to all the additional zones. Modify the existing annunciator to include and indicate the new zone.

PART 2 - PRODUCTS

PRODUCTS
Call Station
The remote call station shall be Cornell 4201B/V vandal resistant with one momentary switch with LED and loudspeaker.
The station shall have hands free voice communication with the annunciator.
The station shall have silk-screened operating instructions.
The station shall be flush wall mounted in a 2-gang stainless steel plate (Cornell)

Power Supply
Modify the existing power supply if required.

SYSTEM OPERATION
Furnish, install and place into operation a two-way communication system for new station where indicated on the plans.
The annunciator shall be added to in the main vestibule at the main building entrance where shown on the drawings to indicate light and tone signals from remote call station
When the call station switch is activated, a red LED button illuminates and a one shot tone sounds.
When the alarm signal is acknowledged, the remote call station is signaled with a flashing light and tone.

Voice communication with the remote call can then be initiated from the annunciated.

**PART 3 - EXECUTION**

**INSTALLATION**

Wiring from the annunciator to the call station shall be Cornell CB-422 custom cable.

Wiring from the annunciator to the power supply shall be 18 gauge, 2 conductor for Cornell system.

Verify cable types with two-way communication system manufacturer.

Complete system shall be installed in strict accordance with manufacturer’s recommendations.

All wiring shall test free from ground and shorts.

**OWNER TRAINING**

Provide complete operator training for the Owner’s personnel.

Use submitted Operations & Maintenance manuals as reference during this demonstration and tour.

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SECTION 27 51 25
INTERCOMMUNICATIONS SYSTEM

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
Conform to requirements of current ANSI/NFPA 70 – National Electric Code.
Conform to current Underwriters Laboratories (UL) Specifications and Standards.
Conform to current Telecommunication Industry Association (TIA/EIA).
Compliant with limits for Federal Communication Commission (FCC) Class B device.
Conform to current National Electrical Manufacturers Associates (NEMA) Standards.
UL Listing - All material and equipment shall be listed, labeled, or certified by Underwriters Laboratories, Inc. The intercom/paging system shall be UL 813 listed as a complete system. All power supplies and computers shall be UL listed. Provide UL listing cards for all components specified herein.
FCC Approval - The telephone system shall be approved under Part 68 of FCC rules and regulations to accommodate the addition of a telephone system. Provide the FCC registration number of the system being proposed. Systems which are not FCC approved will not be considered.

DESCRIPTION OF WORK
The existing intercom is a Simplex system. This system is to be extended into the new addition. All new devices to be compatible with Simplex. Contact Simplex Green Bay
Furnish and install a complete and operable intercommunications system as indicated on the drawings and as specified herein.
All necessary equipment required to meet the intent of these specifications, whether or not listed within these specifications, shall be supplied and installed to provide a complete and operational system.

RELATED WORK ELSEWHERE
Division 26, 27, and 28.

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.
The following information shall be submitted in addition to items listed above:
   Wiring diagram indicating wire size and type for each individual piece of equipment.
   Complete riser diagram indicating all equipment and interconnecting components with indication of location of each device.
   All drawings must be in CADD format.
   Block diagram indicating major system components and their relationship with other components.
A complete riser diagram indicating all head-end and other components with wire type and wiring diagrams.

Submit cut sheets as outlined in specification section 26 05 04 and include system riser diagram, all wire, devices, and provide written confirmation from the factory that they are an authorized representative for the submitted product. This document shall be included as part of the submittal data.

Provide complete brochure information on all components and accessory equipment. All information shall be clearly marked to indicate items provided.

**OPERATION & MAINTENANCE MANUALS**
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

The following information shall be submitted in addition to the items listed above:
- Wiring diagram indicating wire size and type for each individual piece of equipment.
- Complete riser diagram indicating all equipment and interconnecting components with indication of location of each device.
- Provide copy of written warranty.

**QUALITY ASSURANCE**
Provide quality assurance in accordance with Section 26 05 04.

The following shall be provided in addition to items listed above:
- Arrange pre-installation meeting.
- Factory Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer’s products that are similar in material, design, and extent to those indicated for this Project.
- Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- Manufacturer’s Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation. Report results in writing.
- Manufacturer must carry replacement parts.

**WARRANTY**
The supporting devices shall be warranted for a period of not less than 5 years for material and 1 year for labor. Warranty shall start from the date of commissioning.

The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, and repair parts cost.

Submit a written warranty executed by the installer agreeing to repair or replace any intercom equipment that fails within the warranty period.

During the guarantee period there shall be no charges to the Owner for service calls for guarantee work. However, when service work is required to repair items damaged by neglect, misuse, or vandalism, costs shall be reimbursed to this Contractor.
During the warranty period, provide the Owner with one update/revision of schedule.

The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

Guarantee his equipment for a period of five years from date of acceptance of project by the Owner. Neither the final payment, nor any provisions in contract documents shall relieve this Contractor of the responsibility for faulty materials and/or workmanship for a period of one year. Remedy any defects due thereto, and pay for any damage to other work resulting therefrom.

Employ factory trained technical service personnel for service and maintenance of the system should service be required.

Carefully instruct the Owner's technical personnel in the operation, care and maintenance of the system.

It shall be possible for the Owner's technical personnel to attend Service and Maintenance Seminars conducted by the systems manufacturer to educate them in the technical aspects of the system.

**PART 2 - PRODUCTS**

**GENERAL**

Manufacturers:

All base bids shall be based on the equipment as specified herein,

Simplex

All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

Provide a complete and fully functional intercom system using materials and equipment of types, sizes, and rating as required to meet performance requirements. Use materials and equipment that comply with referenced standards and manufacturer’s standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions. Provide all accessories necessary for a fully functioning system.

Qualified Contractor:

All systems herein specified shall be provided by a single source, installed equipment by an Authorized Factory Distributor for the equipment, shall stock spare parts and maintain a staff of trained, certified technicians. A minimum of five years experience in the application of equipment is required.

**INTERCOM SYSTEM EQUIPMENT RACK**

Existing to remain under base bid

**AUDIO PAGING EQUIPMENT**

New Power Amplifier (size as required plus 20% headroom) to accommodate new addition:

**INTERCOM COMMUNICATIONS SYSTEM**

Intercom Field Hardware:
Loudspeakers shall be eight inch seamless cone type. The ceramic magnet shall weigh at least 4.8 ounces. The frequency range shall be from 90 to 15,000 Hz. The normal wattage rating shall be 8 watts with a program rating of 12 watts. The voice coil diameter shall be 3/4” and the impedance 8 ohms. The loudspeaker shall be equipped with a universal matching transformer suitable for use on a 25-volt output line with taps at 1/2, 1, 2 or 4 watts.

Classroom speakers (flush mounted) shall be Simplex type baffle, Back box and tile support or equal by Quam.

Speakers mounted in ceiling spaces where there are not ceilings shall be provided with a surface mounted speaker enclosure with baffle to match above. Provide mounting hardware to mount to bottom of roof deck in gym. Speakers to be Quam System 1 or equal by Simplex.

Building flush horns shall be Simplex with backbox white baffle.

Provide support bridges to allow for lay-in ceiling installation

**WIRE AND CABLE**

The classroom speaker cable shall be a UL listed 2 pair / 18 AWG stranded copper conductor, plenum rated as directed by system vendor.

The speaker cable (halls, outside, etc.) shall be a UL listed 18 AWG stranded copper conductor with plenum rated insulation. Each cable shall have a twisted pair shielded with an aluminum mylar tape shielded material and have an 18 AWG tinned drain wire. The cable shall incorporate an overall plenum rated jacket. Wire to be WPW25224 or equal

**PART 3 - EXECUTION**

**EXAMINATION**

Verify surfaces and areas are ready to receive work.

Verify field measurements are accurate and shown on drawings.

Verify proper power connections are installed.

Proceed with installation only after unsatisfactory conditions are corrected.

All wiring shall test free from grounds and shorts.

**FIELD MEASUREMENTS**

Field verify surfaces where intercom equipment will be located. Verify adequate room for recessed equipment. Adjust locations to satisfy field measurements.

Mounting heights as shown on drawings and details. Coordinate final locations with on-site architect prior to rough-in.

**DELIVERY, STORAGE & HANDLING**

Receive, sign for, and store all equipment in this section.

Maintain original quality and condition of equipment while it is in storage.

**INSTALLATION**

General:

The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.
Install all fixtures, materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

Install power supplies as required based on equipment per manufacturer.

Mount all equipment except portable equipment firmly in place. Clearly, logically and permanently mark all switches, jacks and receptacles.

Provide for adequate ventilation in all equipment racks and take precautions to prevent electromagnetic or electrostatic hum. The installation of all work shall be neat and of professional quality. Cooperate with other trades in order to achieve well coordinated progress and satisfactory final results. Execute without claim for extra payment minor moves or changes in equipment locations to accommodate equipment of other trades or the architectural symmetry of the facility.

Cable Installation:

Install all equipment per manufacturer’s instructions and directions.

In areas where cable trays are not used for cable installation, a "J-hook" or "D-ring" support system shall be used throughout. Maximum spacing between support hooks shall be 3' on center. Cables shall not be installed in a hap-hazard manner across the ceiling grid system. The following method shall be used:

Conduits acting as cable raceways that are stubbed into the accessible ceiling space shall be extended into the nearest corridor space, or, as an option, the contractor shall install a sleeve through any wall separating the room from the corridor area.

Cables shall be routed at 90 degrees from the room to the support system in the corridor. In the event that there is not adequate corridor space, the support system may be moved into the adjacent rooms. Make modifications, as necessary, in the support system to minimize cable lengths.

J-hook system shall be installed in straight lines perpendicular, right angle to the building walls. Groups of J-hooks shall be used where the single bridal ring system is not adequate to support the cabling.

The support system shall be used up to the conduits that feed the cables into the outlet or cable distribution points. Mark the record drawings to indicate the approximate path of the support system.

Mark the "record drawings" to indicate the approximate path of the J-hook system.

Provide and install all wall sleeves and penetrations. Any place that a wall is penetrated to route cable through the wall, provide a through-the-wall sleeve. It shall be steel conduit with insulated connectors on ends in those areas where plenum ceilings are used. For each door entering each room, include in pricing, the cost of providing and installing one sleeve above all doors entering rooms. These sleeves shall be installed above the ceiling grid.

In those areas where there is not an existing ceiling, all system cables shall be routed through conduit, through the non-ceiling area, into an area where there is ceiling cavity. There shall be no open cables routed through ceiling areas, unless it is indicated otherwise on the drawings.

Installation of Cabling in Existing Facilities:

The following shall be the criteria for the installation of low voltage systems in existing facilities:

All cable shall be run concealed. This shall be:
Above grid ceilings where grid ceilings or other ceiling structures are available. See
description above for installation in ring support system or tray.

In raceway; in open ceiling spaces such as mechanical rooms, shops, storage facilities.

In surface raceway; in finished spaces, such as; classrooms, offices, corridors and
hallways.

Provide surface raceway with accompanying surface boxes on ceilings and walls.

Provide and install all wall sleeves and penetrations. Any place that a masonry wall is penetrated
to route cable through the wall, provide a through-the-wall sleeve. This may be PVC conduit in
those areas where plenum cable is not used. It shall be steel conduit with insulated connectors on
the end in those areas where plenum cable is used.

In those areas where through-the-floor or through-the-ceiling, or through-corridor raceways are
indicated, provide the following:

- PVC conduit may be used in non-plenum ceilings if the raceway type is not called out on
  the plans. If raceway type is indicated, that type of raceway shall be provided.

- Steel raceways shall be terminated with insulated bushings or connectors.

- Where raceways are run through masonry walls, the hole through the wall shall be
  patched tight around the raceway using grout.

- Where raceways are run through existing open ceiling areas, such as stairwells, the
  raceway shall be installed tight to the ceiling and run parallel or perpendicular to the
  existing wall/ceiling angles.

- Floor/ceiling penetrations:
  - Perform all set up, clean up, and any moving and reinstall of owner’s equipment as
    necessary for core drilling floor and ceiling penetrations. Assess the existing areas above
    and below, and make those penetrations in an area appropriate.

  - Relocate any ceiling or floor equipment that may be required to make the penetrations.

- Installation of devices in existing spaces:
  - Move and reinstall any bookcases, desks, tables, chairs, or any other owner’s equipment
    that is in place that requires relocation to allow the installation of the new equipment.
  - This should be worked out with the owner in advance of installation. Coordinate work
times with owner or building tenant in occupied spaces.

- Wiring:
  - Provide conduit systems to accessible spaces only and mount all boxes for the systems wiring. Special
    boxes (i.e. speaker boxes, amplifier boxes, etc.) as shown on the project drawings shall be provided by the
    systems contractor for installation by the Electrical Contractor.

  - It shall be the responsibility of the systems contractor to furnish and install all wire and cable for the
    system.

- Cleaning:
  - Prior to turning the system over to the Owner, the system shall be physically cleaned.
All appearance defects shall be carefully and professionally touched up so that the equipment is in “factory new” condition.

At the completion of the work, remove from the building and the premises all rubbish and debris resulting from the work.

Raceways:
- All screws used on signal devices, including speakers, shall be of the tamperproof type.
- There shall be no sharp edges with installed materials.

Cable:
- Cable type, size, and quantity to be as shown on drawings. Vendor to verify exact cable required based on the equipment and provide appropriate cable.
- All wire runs shall be continuous lengths, without splices.
- All wiring systems shall be color coded as shown on the drawings. Green conductors shall be used only for grounding conductors, white only for neutral conductors, and black shall be reserved for 120-volt line.
- All control wiring systems shall use stranded copper conductors terminated with crimp connectors or lugs, correctly sized for the termination, and applied to the conductor with a crimping tool intended for use with the lug used, or to terminal strips providing 360 degree capture of the wire.
- All field terminal blocks shall be 300 volts minimum NEMA rated, or as required by the NEC for the specific application, and be able to accommodate no less than two (2) #14 AWG wires.
- Marker strips shall be attached to the field wiring. These markers shall not change when devices are replaced during repair or maintenance.
- Within equipment cabinets, all wires and cables shall be contained in wire management channels such as Panduit or equal, and dressed and labeled in such a manner that all wires may be easily traced, and such that they do not obstruct access to components which may need to be replaced or serviced.
- All low voltage cabling to be routed in “D” rings.

Grounding:
- All equipment shall be grounded in accordance with NEC, these specifications and drawings, and the equipment supplier’s recommendations.
  - Each cabinet frame shall be grounded. Equipment cabinets shall be bonded directly to the building electrode grounding.
  - All equipment installed in a cabinet shall be bonded to the cabinet frame.

On Site Programming:
- The system supplier shall provide on-site programming. He shall program the unit in conjunction with the owner’s requirements. The systems supplier shall plan on spending a minimum of one day on site with the owner to provide all programming for the system.

Final Testing:
- The completed intercom system shall be fully tested by the Contractor in the presence of the Owner’s representative and the Engineer. Upon completion of a successful test, the Contractor shall so certify in writing to the Owner.
All wiring shall test free from all grounds and shorts.

Upon completion of the installation, the system must be tested by the manufacturer's representative and all necessary modifications and/or adjustments must be made to assure compliance with this specification.

Upon completion of the testing, the manufacturer or his representative shall issue to the Owner a letter of certification attesting to the fact that he has tested and adjusted the system, that all components are properly installed and free of defects, and that the system is in compliance with this specification.

**OWNER TRAINING**

Provide complete operator training for the Owner’s personnel.

**Diagrams, Drawings and Instruction Manuals**

Furnish bound instruction manuals for the complete system for the Owner's use.

Manuals shall include instructions, block and schematic diagrams, wiring diagrams, specification and technical data of the components, and "as-built" drawings of the completed system.

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SECTION 28 31 00
ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

APPLICABLE PROVISIONS
Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specification sections, apply to work of this section.

APPLICABLE PUBLICATIONS
NFPA 70 - National Electrical Code (NEC) generally, and Article 760 in particular
NFPA-72 – National Fire Alarm Code
NFPA-90A - Installation of Air Conditioning and Ventilating Systems
Local and State Codes
National Electrical Manufacturer's Association (NEMA)
Underwriters' Laboratories, Inc. (UL)
UL-864 Control Units for Fire Protective Signaling Systems
UL-268 Smoke Detector for Fire Protective Signaling Systems
UL-217 Smoke Detectors for Single and Multiple Station
UL-521 Heat Detectors for Fire Protective Signaling Systems
UL-464 Audible Signaling Appliances
UL-1971 Visual Signaling Appliances
UL-38 Manually Actuated Signaling Boxes
UL-1481 Power Supplies for Fire Protective Signaling Systems

DESCRIPTION OF WORK
Expand the existing Simplex fire alarm into the remodeled areas. Contact Simplex Green Bay.
The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations associated with the installation of the new devices as shown on the drawings and as herein specified.

RELATED WORK ELSEWHERE
Division 26, 27, and 28 – Electrical.
Division 23 – Heating, Ventilation and Air Conditioning

SHOP DRAWINGS
Submit shop drawings in accordance with Section 26 05 04.
The following information shall be submitted in addition to items listed above:
Wiring diagram indicating wire size and type for each individual piece of equipment.
Complete riser diagram indicating all equipment and interconnecting components with indication of location of each device.
All drawings must be in CADD format.
Block diagram indicating major system components and their relationship with other components.
A complete riser diagram indicating all head-end and other components with wire type and wiring diagrams.

Submittal drawings:
Provide submittal drawings that are in compliance with State requirements for fire alarm system submittals. This shall include:
- Battery calculations
- Voltage drop calculations for all signal lines
- Sequence of operation
- Wiring diagrams
- Floor plan layout of all fire alarm devices indicating candela levels on each individual signal.

These shall be used for fire alarm submittals. This information shall be included with each set of fire alarm shop drawings.

Provide each submittal booklet with a table of contents that includes all items in submittal, specifically it shall include the following. This page shall be a separate page to allow engineer’s stamp for State submittal.
- Page listing for battery calculations.
- Page listing for voltage drop calculations for all signal lines.
- Page listing Sequence of Operation.
- Page listing catalog cut sheets.
- Page listing all other items that are included in the booklet.
- Full set of fire alarm drawings with fire alarm devices indicated and proper candela levels indicated on those devices. The electrical engineer will forward bid-set CAD drawings to contractor or supplier.

Riser diagram with wire sizes indicated shall be shown on floor plan drawings per State of WI requirements.

Provide (1) one additional set of drawings and booklet along with (3) three additional drawings cover sheets for State fire alarm review.

This vendor is responsible to submit all fire alarm drawings to state and local authorities as required and include in bid all associated fees.

OPERATION & MAINTENANCE MANUALS
Submit Operations & Maintenance Manuals in accordance with Section 26 05 04.

The following information shall be submitted in addition to the items listed above:
- Wiring diagram indicating wire size and type for each individual piece of equipment.
- Complete riser diagram indicating all equipment and interconnecting components with indication of location of each device.
- Provide copy of written warranty and copy of contract for 2 year monitoring service.
QUALITY ASSURANCE
Provide quality assurance in accordance with Section 26 05 04.

The following shall be provided in addition to items listed
    Arrange pre-installation meeting.

Factory Authorized Service Representative Qualifications: An authorized representative of manufacturer
who is trained and approved by manufacturer to inspect installation of manufacturer’s products that are
similar in material, design, and extent to those indicated for this Project.

Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar
in material, design, and extent to that indicated for this Project, whose work has resulted in construction
with a record of successful in-service performance.

Manufacturer’s Field Services: Where indicated, engage a factory-authorized service representative to
inspect field-assembled components and equipment installation. Report results in writing.

Manufacturer must carry replacement parts.

WARRANTY
The supporting devices shall be warranted for a period of not less than 2 years from the date of commissioning
against defects in materials and workmanship.

The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, and repair
parts cost.

Submit a written warranty executed by the installer agreeing to repair or replace any fire alarm equipment that fails
within the warranty period.

During the warranty period, provide the Owner with one update/revision of schedule definitions, i.e.:
    Revise schedule of openings assigned to groups.
    Revise functions allowed at openings as long as no hardware or wiring changes are required.
    Provide one revision of the computer graphic displays (floor plans).

The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract
Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the
requirements of the Contract Documents.

System Service Support:
    The system's vendor must employ factory trained technicians and maintain a service organization within
    100 miles of the job site. This organization must have a minimum of 10 years experience servicing fire
    alarm systems and provide 24 hour emergency service.

PART 2 - PRODUCTS

GENERAL
The contractor shall provide a fire alarm system manufactured by:
    Simplex

All materials and equipment furnished shall be current production of manufacturers regularly engaged in the
manufacture of such items, and for which replacement parts are available. All materials and equipment shall be UL
Provide a complete and fully functional fire alarm system using materials and equipment of types, sizes, and rating as required meeting performance requirements. Use materials and equipment that comply with referenced standards and manufacturer’s standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions. Provide all accessories necessary for a fully functioning system.

**MULTIPLE ADDRESSABLE NETWORK (MANET)**

All addressable devices are to have the capability of being disabled or enabled individually.

Addressable devices may be multi-dropped from a single pair of wires.

A Mapnet Isolator shall be required to isolate each zone of addressable devices. The isolator module shall operate as an addressable device with the same capabilities of enable, disable, and annunciation.

The communication format must be a poll/response protocol to allow t-tapping of the wire to addressable devices and be completely digital. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission protocol. Systems that do not utilize full digital protocol (i.e. that may use time pulse width methods to transmit data etc.) will not be acceptable.

Each addressable device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.

Wiring types will be approved by the equipment manufacturer. The system must allow up to 2,500 feet wire length to the furthest addressable device.

**EXTERNAL DEVICES**

**Visual Flashing Lamps (Xenon Strobe) dry locations:**

Visual indicating appliances shall comprise a Xenon flashtube and be entirely solid state. These devices shall be UL listed and comply with current ADA requirements, producing the candela listings as indicated below and be capable of either ceiling or wall mounting. Visual units shall incorporate a built-in reflector to improve lighting characteristics.

Candela requirements per NFPA 72 as shown on drawings.

The LEXAN lens shall be pyramid shaped to allow better visibility. Provide vandal resistant unit. Visual units shall be incorporated as part of every horn assembly and shall be individually mounted where shown on the drawings.

The location of the visual indicator is approximate. Install in the room, at any location, as long as the indicator can be viewed from all usable spaces within the room. Mount visual indicator where it does not conflict with other wall finishes or other equipment.

Color shall be red for wall mounted devices and white for ceiling mounted devices.

**Audible/Visual Notification Alarm Appliance (horn/ strobe) dry location:**

Audible units shall provide a common enclosure for the fire alarm audible and visual alarm devices. The unit shall be complete with a tamper resistant, Pyramidal shaped lexan lens with "Fire" lettering visible from a 180 degree field of view. The front panel or bezel which is constructed of UL Listed Noryl, may be inverted so that the lens is below the audible device.

Integral Xenon strobe shall be adjustable from 1 to 3 flashes per second.
Candela requirements per NFPA 72 as shown on drawings.

Xenon strobe shall provide 4 wire connections to insure properly supervised in/out system connection. Unit shall be complete with all mounting hardware including backbox, for semi-flush mounting. For existing construction, surface mounted unit may be provided. All surface hardware shall be painted to match device color. Visual unit shall be UL Listed for its intended purpose and comply with current ADA 1971 requirements. Units shall be vandal resistant.

Color shall be red for wall mounted devices and white for ceiling mounted devices.

Addressable Peripheral Devices: The system control panel, over its two wire multi-drop channel, must be capable of communicating with the types of addressable devices specified below. Addressable devices will be located as shown on the drawings.

Addressable Pull Stations:
Addressable pull stations will contain electronics that communicate the station's status (alarm, normal) to the control panel over two wires which also provide power to the pull station. The address will be set on the station. The stations will be manufactured from high impact red Lexan. Lettering will be raised and painted white. The station will mechanically latch upon operation and remain so until manually reset by opening with a key common to all systems locks. Pull stations shall be double action, push/pull.

The front of the station is to be hinged to a backplate assembly and must be opened with a key to reset the station. The key shall be common with the control panels. Stations which use Allen wrenches or special tools to reset will not be accepted. The station shall consist of high impact Lexan, red in color.

The addressable manual station shall be capable of field programming of its "address" location on an addressable signaling line circuit.

There shall be no limit to the number of stations, detectors or Zone Adapter Modules, which may be activated or "in alarm" simultaneously.

The addressable manual station shall be Underwriter's Laboratories, Inc. listed.

Smoke Sensors:
The smoke sensors shall be of the photoelectric type and shall communicate actual chamber values to the system control panel.

The smoke sensors and bases shall be listed to UL Standard 268 and documented compatible with the control equipment to which they are connected. The sensors shall be listed for both ceiling and wall mount applications.

Photoelectric Sensor Head:
The sensor shall be of the solid state photoelectric type and shall contain no radioactive material. They will use a pulsed infrared LED light source and be sealed against rear air flow entry.

The photoelectric type sensor shall be a plug-in unit which mounts to a twist-lock base.

The sensor shall fit into a base that is common with both the heat sensor and ionization type sensor and shall be compatible with other addressable detectors, addressable manual stations, and addressable Zone Adaptor Modules on the same circuit.

There shall be no limit to the number of sensors, stations or Zone Adaptor Modules which may be activated or "in alarm" simultaneously.
Each sensor will be capable of sensing up to (7) sensitivity levels ranging between .5% and 3.7%.

The photoelectric sensor shall have a fine 30 mesh insect screen.

The sensor electronics shall be completely shielded to protect against false alarms from EMI and RFI (Electromagnetic and Radio Frequent Interference).

Thermal (Heat) Sensor Head:

The Thermal type sensor shall be a plug-in unit which mounts to a twist-lock base.

The sensor shall be a combination rate of rise/fixed temperature sensor U.L. listed as a rate compensated heat detector unless otherwise indicated on plan.

The sensor shall fit into a base that is common with both photoelectric and ionization sensors and shall be compatible with other addressable detectors, addressable manual stations, and addressable Zone Adapter Modules on the same circuit.

There shall be no limit to the amount of sensors, stations or Zone Adapter Modules, which may be activated or "in alarm" simultaneously.

Each sensor is capable of operating at a selectable rate of rise operation of 15 or 20° Fahrenheit per minute and is self-restorable.

Each sensor is capable of fixed temperature operation selectable for either 117 or 135° Fahrenheit, independent of the rate of rise setting.

Each sensor can be configured for utility monitoring and capable of sensing temperature between 32 and 158° Fahrenheit.

Where 200° F fixed temperature heat detector is noted on plan, as an option, provide conventional heat detector with addressable control module in lieu of addressable 200° F fixed heat detector.

Photoelectric Duct Detector:

The sensor shall be photoelectric type, which obtains its operating power from the supervisory current in the fire alarm detection loop.

Sensors shall be of the solid state photoelectric type and shall operate on the light scattering, photodiode principle. To minimize nuisance alarms, detectors shall have a minimum 30 mesh insect screen and be designed to ignore invisible particles or smoke densities that are below the factory set point. No radioactive material shall be used.

Detector construction shall have a mounting base with a twist-lock sensing head. The locking feature must be field removable when not required. Contact between the base and head shall be of the bifurcated type utilizing spring type, self-wiping contacts. Removal of the sensor head shall interrupt the supervisory current of the fire alarm detection loop and cause a trouble signal at the control panel. Detector design shall provide compatibility with other addressable detectors, addressable manual stations and addressable zone adapter modules on the same circuit.

For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.

Auxiliary DPDT relays and/or remote LED alarm indicators with key test switch shall be provided for each duct detector.
Activation of relays shall be performed through the system program. Tracking the alarm only condition of the duct sensor is not acceptable.

Each sensor base shall contain a LED that will flash each time it is scanned by the control panel (once every 4 seconds). When the control panel determines that a sensor is in the alarm or a trouble condition, the control panel shall command the LED on that sensor's base to turn on steady indicating the abnormal condition. Sensors which do not provide a visible indication of an abnormal condition at the sensor location shall not be acceptable.

Each sensor shall be scanned by the control panel for its type identification to prevent inadvertent substitution of another sensor type. The control panel shall operate with the installed device but shall initiate a "Wrong Device" trouble condition until the proper type is installed or the programmed sensor type is changed.

The sensor's electronics shall be immune from false alarms caused by EMI and RFI.

Provide a remote alarm/power LED key test switch indicator for each duct smoke detector that is more than 10' high or cannot be seen (NFPA Code). Indicators to be mounted at 48" above finished floor into the area where the smoke detector is located.

In mezzanine areas or other areas where air handlers are located, provide remote indicator near doorway or stairway entering into the room. Installation of remote detector shall be coordinated with other equipment in the mechanical equipment room. Every unit shall be equipped with an engraved nameplate indicating which air handler it handles. Every smoke detector on the air handler or the air handler shall have a 1" x 3" engraved label clearly indicating which air handler it is. If the remote indicator is not shown on the floor plans, get direction from the Architect or Engineer to determine the location of the detector.

Addressable Sensor Bases:

Sensor bases shall be compatible with all models of sensors. Each base is capable of communicating sensor values to the panel if a "wrong device type" trouble condition is present. The panel will continue to monitor for alarms and troubles using the default setting for the wrong device until the proper type is installed or the program is changed.

Each sensor base shall contain a LED that will flash each time it is scanned by the control panel (once every 4 seconds). When the control panel determines that a sensor is in the alarm or a trouble condition, the control panel shall command the LED on that sensor's base to turn on steady indicating the abnormal condition. Sensors which do not provide a visible indication of an abnormal condition at the sensor location shall not be acceptable.

Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.

The sensor base shall annunciate power-on, alarm and trouble conditions locally at the base.

In addition, where shown on plans, the sensor base shall remotely annunciate power-on, alarm and trouble conditions using a remote LED indicator.

Sensor Base with Relay:

Where shown on plans, for elevator smoke detectors, and for smoke detectors associated with smoke doors, the sensor base shall include a control relay for programmable function.

The relay shall not take any additional addressable device capacity.

The relay shall provide (2) sets of Form C contacts rated 3 amps and powered from the system 24 VDC and operate in battery standby.
Relay shall mount in same electrical box the sensor base is installed on.

Wire relay to interconnect with magnetic hold opens where shown on drawings. The smoke detector shall be configured such that the smoke detector will directly control the magnetic hold-open devices and will cause only those doors associated with the detector to close. All doors shall not close at once.

Fire Alarm Control Multiplex Operation:

The system shall be capable of providing multiplex operation by using the fire alarm control panel as a central processing unit (CPU) that provides Style 4 or Style 7 communications up to 31 remote transponders. All data communications wiring between the CPU and transponders shall be supervised for opens, shorts, and grounds. The remote transponders shall be capable of containing up to 31 selectable fire alarm control panel modules to provide the following functions:

- Interface modules, each capable of communicating to up to 127 devices via the Multiple Addressable Peripheral detectors, smoke sensors, and other addressable initiating and control devices as described in section 9.
- Power supply and charger capable of providing 8 amps of system power and capable of charging up to 50 AH batteries powered by 120 HVA, 60 Hz.
- Initiating circuits for Style B or Style A operation.
- Notification Appliance circuits for Style Y or Style Z.
- Auxiliary control relay circuits with feedback to monitor circuit connection.
- Isolator module to provide line isolation of shorted segments.
- Input/Output Graphic Driver Interface.
- Front panel mounted status indicating LEDs including with provision for selecting and changing LED color on-site.
- Momentary switches with status indicating LEDs.
- Three position (on-off-auto) maintained switches with status indicating LEDs.

Packaging shall include solid door with beige paint.

AHU SYSTEM INTERFACE

Duct Smoke Detectors and Addressable Control Modules, or Supervised Remote Relays shall be provided as specified below. Duct Smoke Detectors shall be installed in compliance with the manufacturer’s recommendations. Each Addressable Control Module or Supervised Remote Relay for AHU and / or Fan shutdown shall be installed within 3 feet of the Temperature Control Panel to which it is connected. The Division 26 EC shall provide all wiring and terminations required for shutdown of the specified AHUs / Fans.

The Addressable Control Modules or Supervised Remote Relays provided for this purpose shall be provided with DPDT output contacts. One SPDT set of the DPDT contacts shall be utilized for the specified shutdown function. The second SPDT set of the DPDT contacts shall be available for connection to the temperature controls, to indicate that unit shutdown – due to Duct Smoke – has occurred.

The control panel shall provide an output alarm interface to the air handling/energy management system controllers, which in turn shall perform automatic function as specified in the applicable sections of Division 15.
An override feature / control switch shall be provided which shall prevent shutdown of AHUs when this function is active.

Provide control module at all smoke and combination fire/smoke dampers shown on drawings. Control module shall close dampers upon actuation of any associated duct smoke detector. Provide 120V power connection to all smoke and combination fire/smoke dampers shown on plan, see drawings.

Programming: (This shall apply to All AHUs / Fans listed above):
Upon actuation of a duct smoke detector installed at the AHU or at any associated smoke and/or combination fire/smoke damper, the AHU shall shut down and all smoke and/or combination fire/smoke dampers associated with that AHU shall be closed.

The associated fan shall be shut down only upon actuation of the duct smoke detector associated with the particular unit.

Upon actuation of corridor smoke detectors (if shown) installed at same corridor smoke and/or combination fire/smoke dampers are located in, the associated damper shall close. The associated AHU shall be shut down.

All such AHUs / fans shall remain shut down, until a valid System Reset occurs.

**PART 3 - EXECUTION**

**EXAMINATION**
Verify surfaces and areas are ready to receive work.
Verify field measurements are accurate and shown on drawings.
Verify proper power connections are installed.
Proceed with installation only after unsatisfactory conditions are corrected.
All wiring shall test free from grounds and shorts.

**FIELD MEASUREMENTS**
Field verify proper mounting heights of all devices.
Field verify surfaces which equipment will be located. Verify adequate room for recessed equipment. Adjust locations to satisfy field measurements.
Mounting heights as shown on drawings and details. Coordinate final locations with on-site architect prior to rough-in.

**DELIVERY, STORAGE & HANDLING**
Receive, sign for, and store all equipment in this section.
Maintain original quality and condition of equipment while it is in storage.

**INSTALLATION**
General
The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer’s recommendations.
Install all materials, assemblies and equipment in strict accordance with manufacturer’s recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.
Start of installation shall not begin until areas are broom clean, properly lighted, exterior enclosing walls in place, exterior windows glazed, roof completely installed to prevent weather damage to equipment, and written notice received by ESC from Architect stating that these conditions exist at building site.

Install power supplies as required based on equipment per manufacturer.

Cleaning
Prior to turning the system over to the Owner, the system shall be physically cleaned.
All appearance defects shall be carefully and professionally touched up so that the equipment is in “factory new” condition.
At the completion of the work, remove from the building and the premises all rubbish and debris resulting from the work.

System Wiring
The system wiring and installation shall be in compliance with applicable codes, project drawings and as required by the manufacturer. All wiring shall be color coded, tagged and checked to assure that it is free from shorts and grounds. Provide record drawings of installation.

Note: Electrical contractor shall provide duxseal at each smoke detector to seal the conduit.
All wiring shall be installed in free-air wiring.

Free Air Wiring:
A/E shall identify all plenum areas on the drawings and install the proper wiring type.
All wiring shall be run “free-air”, in conduit or in surface raceway. "Free-air" wiring for horizontal cable runs of Power Limited Fire Alarm (PLFA) DC circuits as approved by the Engineer shall be the method of installation in the following areas:
   Finished accessible ceiling.
   Rooms designated as ‘mechanical’ rooms.
All other wiring shall be installed in conduit or surface metal raceway. Surface metal raceway shall be used on finished walls and ceilings along with the manufacturers designed boxes and fittings for the raceway.
Where installed “free-air”, installation shall consider the following:
   Cable shall run at right angles and be kept clear of other trades work.
   Cables shall be supported according to code utilizing "Bridal-type" mounting rings or J hooks anchored to ceiling concrete, piping supports or structural steel beams. Rings shall be designed to maintain cables bend to larger than the minimum bend radius (typically 4 x cable diameter).
   Supports should be spaced at a maximum 4-foot interval unless limited by building construction. If cable "sag" at mid-span exceeds 12-inches, another support shall be used.
   Cable shall never be laid directly on the ceiling grid.
   Cables shall not be attached to or supported by, existing cabling, plumbing or steam piping, ductwork, ceiling supports or electrical or communications conduit.
A coil of 2 feet in each cable shall be placed in the ceiling at each “free-air” wired fire alarm device. These "service loops" shall be secured at the last cable support before the cable reaches the device and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

Devices wired with conduit shall be provided with an 8-inch wire tail at each device box and 36-inch wire tails at the FACP and FAAP.

To reduce or eliminate EMI, the following minimum separation distances from <480V Power lines shall be adhered to:

- Twelve (12) inches from power lines of <5-kVA.
- Eighteen (18) inches from high voltage lighting (including fluorescent).
- Thirty-nine (39) inches from power lines of 5-kVA or greater.
- Thirty-nine (39) inches from transformers and motors.

All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kell um grips may be used to spread the strain over a longer length of cable.

Manufacturers minimum bend radius specifications shall be observed in all instances. Care should be taken in the use of cable ties to secure and anchor the station cabling. Ties should not be over tightened as to compress the cable jacket. No sharp burrs should remain where excess length of the cable tie has been cut.

All vertical cable extensions to fire alarm devices located below the finished ceiling shall be in conduit.

It is the contractors' responsibility to survey the site and include all necessary costs to perform the installation as specified. This includes any modifications required to route and conceal horizontal distribution wiring.

Beginning installation means contractor accepts existing conditions.

Contractor shall furnish all required installation tools to facilitate cable pulling without damage to the cable jacket. Such equipment is to include, but not limited to, sheaves, winches, cable reels, cable reel jacks, duct entrance tunnels, pulling tension gauge and similar devices. All equipment shall be of substantial construction to allow steady progress once pulling has begun. Makeshift devices, which may move or wear in a manner to pose a hazard to the cable, shall not be used.

All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to insure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a “break-away” or other approved method.

The contractor will be responsible for identifying and reporting to the Site Coordinator(s) any existing damage to walls, flooring, tiles and furnishings in the work area prior to start of work. The Contractor must repair all damage to interior spaces caused by the installation of cable; raceway or other hardware. Repairs must match preexisting color and finish of walls, floors and ceilings. Any contractor-damaged ceiling tiles are to be replaced to match color, size, style and texture.

Where unacceptable conditions are found, the Contractor shall bring this to the attention of the construction supervisor immediately. A written resolution will follow to determine the appropriate action to be taken.

Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all installation work. During pulling operation an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.
Cable pulling shall be done in accordance with cable manufacturer’s recommendations and ANSI/IEEE C2 standards. Manufacturer’s recommendations shall be a part of the cable submittal. Recommended pulling tensions and pulling bending radius shall not be exceeded. Any cable bent or kinked to radius less than recommended dimension shall not be installed.

Avoid abrasion and other damage to cables during installation.

Pulling Lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to the cable jacket and other materials used. Lubricant shall not harden or become adhesive with age.

A pull cord (nylon; 1/8” minimum) shall be co-installed with all cable installed in any conduit.

Conductors

All wire and cable associated with this system shall be as required by the equipment manufacturer. The following information is intended for estimating purposes only. However, the minimum wire gauges and colors specified shall be strictly adhered to. All cable shall be installed as per NEC Article 760.

Type FPL wiring is required if the system is run in conduit or ‘free-air’.

All initiation and notification circuit cabling shall be listed Type FPL (300V) in accordance with NEC article 760."

All cables and wires #14 AWG and larger shall be stranded.

Fire alarm wiring shall be held in place at the device box, by means of a two-screw connector, (do not use squeeze or crimp type connectors).

All wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, disarrangement of any components, any open circuits or grounds in the system, an audible and visual trouble signal shall be activated until the system is restored to normal.

All conductors shall be color-coded. Coding shall be consistent through out the facility. Green wire shall be used only for equipment ground.

Power wiring shall be #12 AWG.

Fire Alarm Control Panel, and Annunciator Panel shall have #6 AWG green equipment ground wire.

Where fire alarm circuits enter or leave a building, additional transient 75 to 90 volt gas tube protection shall be provided for each conductor.

Leave 8-inch wire tails at each device box and 36-inch wire tails at the Fire Alarm Control Panel [and Remote Annunciator Panel(s).

Cable for Intelligent detector Loops shall be 18 to 12 AWG twisted pair with a shield jacket installed in ½” conduit. Shield continuity must be maintained and connected to earth ground only at the control panel.

SLC wiring must not be in the same conduit with AC power wiring or other high current circuits. T-taps or branch circuit connections are allowed for all class B SLCs.

All splices or connections shall be made within approved junction boxes and with approved fittings. Boxes shall be red and labeled "FIRE ALARM SYSTEM" or “FA” by decal or other approved markings.

Horn and strobe circuits shall have separate conductors, and shall operate independently of each other.
Horn wiring shall be #14 AWG minimum or as recommend by manufacturer.

Strobe wiring shall be #14 AWG minimum or as recommend by manufacturer.

Tray cable is not acceptable for use as fire alarm system wiring installed in conduit.

All cable run as “Free-Air” shall be Tray Cable rated.

Grounding

All equipment shall be grounded in accordance with NEC, these specifications and drawings, and the equipment supplier’s recommendations.

Each cabinet frame shall be grounded. Equipment cabinets shall be bonded directly to the building electrode grounding.

All exterior panels of cabinets shall be bonded to the cabinet frame.

All equipment installed in a cabinet shall be bonded to the cabinet frame.

Mounting Heights

Mounting heights:

Fire alarm station: 42” to center

Fire alarm signals and strobes- 80” above the floor (shall be to the highest point in the space i.e. above highest riser level in Band rooms, highest floor level in Auditoriums, etc.) to bottom or 6” below the ceiling, whichever is lower.

Fire alarm power panels: 48” to bottom

Programming

All programming that is required for installation shall be done by this contractor. The contractor shall assume that his vendor is to meet with the owner to determine if there are any extraordinary programming circumstances. The supplier shall go over the entire sequence of operation of the fire alarm panel and explain what the various programming sequences are.

Device addresses shall utilize Owner’s room numbers and not room numbers provided on drawings. Include building area in address. See floor plan graphic description for additional information.

Junction Boxes

Provide fire alarm pull and junction boxes per specification section 26 05 53.

Final Testing

The completed fire alarm system shall be fully tested in accordance with NFPA by the Contractor in the presence of the Owner’s representative and the Engineer. Upon completion of a successful test, certify in writing to the Owner.

All wiring shall test free from all grounds and shorts.

The completed system shall be tested in accordance with NFPA 72. Provide a certified test report from the manufacturer's representative that the system complies with NFPA and State codes. All technicians performing work on this project shall be factory trained and at minimum, NICET level two certified in fire alarm systems.
Fill out the fire alarm system checklist included as a part of this specification. This checklist shall be included with the final O&M operation manual and will be required prior to final payment being made on this equipment.

**MOUNTING OF SMOKE DETECTORS**

Smoke detectors shall not be installed until final room finishes and carpeting have been laid. As an option to this, the contractor may install the smoke detector, but it must be protected by a plastic bag to prevent dust entering the smoke detector. Install the smoke detectors in this manner to prevent erroneous alarms. If smoke detectors are installed prior to final room finishes being completed and floor finishes being installed, this contractor shall bear the expense of returning the smoke detectors to the factory for cleaning and recalibration.

**OWNER TRAINING**

Provide complete operator training for the Owner’s personnel.

Use submitted Operations & Maintenance manuals as reference during this demonstration and tour.

Have owner sign certificate stating that he has received instruction on the fire alarm equipment; see spec section 26 05 04.

**SPARE EQUIPMENT (NONE)**

END OF SECTION 28 31 00
# FIRE ALARM SYSTEM STARTUP CHECKLIST

<table>
<thead>
<tr>
<th>Date</th>
<th>Building Name</th>
<th>Facility Owner</th>
<th>Installing Contractor</th>
<th>Equipment Supplier</th>
<th>Equipment Manufacturer</th>
<th>Factory Authorized Technician</th>
</tr>
</thead>
</table>

Each fire alarm pull station must be individually tested for system activation and proper zone annunciation. This was done and tested and is in compliance.

- **Yes** ______  **No** ______  **NA** ______

Each room smoke detector must be individually tested for system activation and proper zone annunciation and remote indicator operation. This was done and tested and is in compliance.

- **Yes** ______  **No** ______  **NA** ______

Each heat detector was individually tested for system activation and proper zone annunciation. This was done and tested and is in compliance.

- **Yes** ______  **No** ______  **NA** ______

Each duct detector was individually tested for fire alarm system activation, and air handler shut down. Only that air handler protected by a smoke detector shall shut down. This was done and tested and is in compliance.

- **Yes** ______  **No** ______  **NA** ______

Each fire door opens and ceiling mounted detectors was tested for fire alarm activation, door closure and proper zone annunciation. Note that this shall be tested so that only those doors that are connected with the local smoke detectors are to close; no other doors are to close. This was done and tested and is in compliance.

- **Yes** ______  **No** ______  **NA** ______

Each smoke damper was tested for fire alarm activation. Note that this shall be tested so that the dampers will close the damper. This was done and tested and is in compliance.

- **Yes** ______  **No** ______  **NA** ______

I hereby certify that the fire alarm system was tested as indicated above. It was found to be operating and complies with State and NFPA codes.

**Signed** ____________________________  **Printed Name** ______________________________

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System Designer:
Muermann Engineering, LLC
116 Fremont Street
P.O. Box 235
Kiel, WI 53042
Phone (920) 894-7800
PART 1 - GENERAL

SCOPE
This section provides information common to two or more technical site work specification sections or items that are of a general nature, and not included in other sections. This section applies to ALL site work, as applicable.

Included are the following topics:

PART 1 - GENERAL
Scope
Related Work
Referenced Organizations
Referenced Documents
Quality Assurance
Safety
Construction Limits
Equipment & Materials Furnished by Others
Provisions for Future Work
Work by Others
Submittals
Off Site Storage
Codes
Certificates and Inspections

PART 2 - MATERIALS
Barricades, Signs, and Warning Devices
Temporary Plastic Barrier Fencing

PART 3 - EXECUTION
Maintenance of Site and Building Access/Egress
Continuity of Existing Traffic/Parking and Traffic Control
Protection and Continuity of Existing Utilities
Protection of Existing Work and Facilities
Stormwater/Excavation Water Management

RELATED WORK
Applicable provisions of Division 1 govern work under this Section.

REFERENCED ORGANIZATIONS
Applicable provisions of Division 1 shall govern all work under this section.

Abbreviations of organizations referenced in these specifications are as follows:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
</tr>
<tr>
<td>ACPA</td>
<td>American Concrete Pipe Association</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
</tr>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>AWWA</td>
<td>American Water Works Association</td>
</tr>
<tr>
<td>AWS</td>
<td>American Welding Society</td>
</tr>
<tr>
<td>FHA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>NEC</td>
<td>National Electric Code</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers Association</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>NSF</td>
<td>National Sanitation Foundation</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
</tbody>
</table>
SECTION 31 05 00
COMMON WORK RESULTS FOR EARTHWORK

STI Steel Tank Institute
UL Underwriters Laboratories Inc.
WDNR State of Wisconsin Department of Natural Resources
WISDOT State of Wisconsin Department of Transportation

REFERENCED DOCUMENTS
Where reference is made to the "SSHSC", it shall mean the pertinent sections of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, and all supplemental and interim supplemental specifications. Where reference is made to the “SSSWC”, it shall mean pertinent sections of the Standard Specifications for Sewer and Water Construction in Wisconsin, current edition. Where reference is made to the “BMPH”, it shall mean the Wisconsin Construction Site Best Management Practice Handbook, current edition as published by the WDNR. Method of measurement and basis of payment sections in referenced documents shall not apply.

QUALITY ASSURANCE
Provide materials and products as required by individual specification sections. Refer to Section GC - General Conditions of the Contract regarding substitutions.

Provide quality assurance testing and reporting as required by individual specification sections.

SAFETY
Contractor is solely responsible for worksite safety.

Perform all work in accordance with applicable OSHA, state and local safety standards.

Contact Diggers Hotline at 1-800-242-8511 in accordance with statutory requirements. Request that non-member utilities and private utilities be located by the appropriate parties.

CONSTRUCTION LIMITS
Construction Limits are indicated on the drawings. In the absence of such a designation on the drawings, confine work to the minimum area reasonably necessary to undertake the work as determined by the Owner. In no case shall construction activities extend beyond state property lines or construction easements.

The Contractor shall restore all disturbed areas in accordance with the drawings and specifications. If plans and specifications do not address restoration of specific areas, these areas will be restored to pre-construction conditions as approved by the Owner.

SUBMITTALS
Refer also to Section GC - General Conditions of the Contract and Division 1.

Submit manufacturer's shop drawings, product data, samples, substitutions and operation and maintenance (O&M) data for approval as required by individual specification sections.

Unless otherwise noted, provide 6 copies of each submittal. Submit to project architect/engineer (A/E) unless otherwise directed by Owner at the Pre-Construction Meeting.
OFF SITE STORAGE
Refer to Division 1.

In general, the payments for materials stored off site will only be considered in instances where there is limited space available for storage on the site. Prior approval by the Owner, together with the execution of a Storage Agreement will be required.

CODES
Comply with the requirements of all applicable, local, state and federal codes.

CERTIFICATIONS AND INSPECTIONS
Refer to Section GC - General Conditions.

Obtain and pay for all required sampling, testing, inspections, and certifications except those expressly listed as provided by the A/E or other third party in the Contract Documents. Deliver originals of certificates and documents to the Owner w/i 3 days; provide copies to the A/E. Include copies of the certifications and documents in the O&M Manual.

PART 2 - MATERIALS

BARRICADES, SIGNS, AND WARNING DEVICES
Traffic barricades, traffic signs, and warning devices shall meet the requirements of applicable OSHA standards and the FHA Manual of Uniform Traffic Control Devices (MUTCD).

TEMPORARY PLASTIC BARRIER FENCING
UV stabilized high-density polyethylene barrier fence free of holes tears and other defects. Provide 4’ tall fence in diamond or rectangular pattern. Fencing shall be “safety orange” color, unless otherwise noted.

Posts for temporary plastic barrier fencing shall be 5’ tall, minimum 12 gauge, painted metal posts.

PART 3 - EXECUTION

MAINTENANCE OF SITE AND BUILDING ACCESS/EGRESS
Unless otherwise shown or directed, maintain existing access and egress to the facility throughout construction. Maintain ANSI A117 compliant access for disabled persons, delivery access, emergency vehicle access, and emergency egress. Do not interrupt access and egress without prior written approval from the Owner.

CONTINUITY OF EXISTING TRAFFIC/PARKING AND TRAFFIC CONTROL
Do not interrupt or change existing traffic, delivery, or parking on neighboring streets without prior written approval from the local municipality and Owner. When interruption is required, coordinate schedule with the Owner agency to minimize disruptions.

When Contractor’s activities impede or obstruct traffic flow, Contractor shall provide traffic control devices, signs and flaggers in accordance with other Contract Documents and the current version of the MUTCD, or as shown on the Drawings.

PROTECTION AND CONTINUITY OF EXISTING UTILITIES
Verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric, telephone/communication, fuel, steam lines or other utilities and site features which may be encountered in any excavations or other sitework. All lines shall be properly underpinned and supported to avoid disruption of service.

Do not interrupt or change existing utilities without prior written approval from the Owner, affected utilities and users. Notify all users impacted by outages a minimum of 48 hours in advance of outage. Notification shall be
provided in writing and describe the nature and duration of outages and provide the name and number of Contractor’s foreman or other contact.

Any service connections encountered which are to be removed shall be cut off at the limits of the excavation and capped in accordance with the requirements of applicable codes and any specifications governing such removals.

**PROTECTION OF EXISTING WORK AND FACILITIES**
Verify the locations of, and protect, any signs, paved surfaces, buildings, structures, landscaping, streetlights, utilities, and all other such facilities that may be encountered or interfered with during the progress of the work.
Take measures necessary to safeguard all existing work and facilities that are outside the limits of the work or items that are within the construction limits but are intended to remain. Report any damage to existing facilities to the Owner immediately. Correct and pay for all damages.

**STORMWATER/EXCAVATION WATER MANAGEMENT**
Control grading around structures, pitch ground to prevent water running into excavated areas.
Pits, trenches within building lines and other excavations shall be maintained free of water.
Provide trenching, pumping, other facilities required.
Notify Architect/Engineer if springs or running water are encountered in excavation; provide discharge by trenches, drains, pumping to point outside of excavation. Provide information to Architect/Engineer of points and areas that water will be discharged. At the Engineer's option, the Contractor shall drain the spring to the storm sewer system by the use of field tile.
Be responsible for control measures to prevent damage from flooding, erosion, and sedimentation to on-site and off-site areas.
SECTION 31 20 00
EARTHTMOVING

PART 1 - GENERAL

SCOPE
The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to complete earthwork required in these specifications and on the drawings. Included are the following topics:

PART 1 - GENERAL
Scope
Related Work
Reference Standards
Submittals
Quality Assurance
Owner Furnished Materials
Provisions for Future Work
Quantities
Surveying and Staking
Record Drawings

PART 2 - MATERIALS
Earth Fill
Granular Fill
Structural Fill

PART 3 - EXECUTION
General
Topsoil Removal
Excavation
Dewatering
Placing and Compacting Material
Bio-Infiltration Basins
Grading Around Trees
Soil Stabilization
Clean Up

RELATED WORK
Applicable provisions of Division 1 govern work under this Section.

31 05 00 – Common Work Results for Earthwork
31 22 16.15 – Roadway Subgrade Preparation
31 23 16.13 – Trenching
31 23 16.16 – Structural Excavation for Minor Structures
31 23 16.26 – Rock Removal
31 25 00 – Erosion Control
32 11 23.33 – Dense Graded Base
32 91 13 – Soil Preparation

REFERENCE STANDARDS
Applicable provisions of Division 1 shall govern all work under this section.

American Society for Testing and Materials (ASTM):
D4318-00 Liquid Limit, Plastic Limit and Plasticity Index of Soils
Geotechnical investigation have been performed at this project location. All work shall be performed in accordance with the recommendations for this site.

**SUBMITTALS**

Provide copies of record drawings.

Provide samples of each type of soil or aggregate proposed for use on the project. Samples shall consist of a minimum of 50 pounds of soil. The contractor shall be responsible for delivering soil samples to the testing agency as designated by the Owner. Provide samples a minimum of 2 weeks prior to starting construction.

Provide copies of all material testing reports to the Owner.

**QUALITY ASSURANCE**

The Contractor shall retain the services of a geotechnical consulting engineer to conduct sampling testing and analysis as required by this section and elsewhere in the Contract Documents. The geotechnical consulting engineer shall meet the requirements of ASTM E329-00b.

The Contractor’s geotechnical consulting engineer shall complete material testing as outlined in Table 31 20 00-1:

<table>
<thead>
<tr>
<th>Material</th>
<th>Test Required</th>
<th>Test/Sample Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fill</td>
<td>D2922-01 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods</td>
<td>Min 2 tests/lift</td>
</tr>
</tbody>
</table>

**QUANTITIES**

Elevations provided on the plans are finished elevations including topsoil. Finish topsoil depth shall be as shown on the drawings.

The site Grading Contractor shall be solely responsible for determining all earthwork quantities based on the existing and proposed elevations provided on the plans. Any geotechnical investigations provided by the Owner apply only to those locations that the data was collected, and may not be indicative of conditions elsewhere on the site. The Contractor is responsible for collecting any additional geotechnical or survey data he deems necessary to complete an accurate estimate of earthwork quantities.
Contractor shall be solely responsible for balancing site materials. If onsite excavation and borrow operations do not provide enough suitable material for fill areas, Contractor shall coordinate and pay for excavation, transport and placement of imported material meeting the specifications of the contract documents. If excavation results in excess materials, Contractor shall coordinate and pay for loading, transport and offsite disposal of excess materials.

If contractor finds the geotechnical information or existing or proposed elevations shown on the plans to be erroneous, he shall notify the Project Manager immediately.

SURVEY AND STAKING
- Contractor shall be responsible to perform all construction staking as necessary to complete his work.
- Prior to the start of demolition/work, re-establish control points as indicated on the construction documents.

Owner or Engineer will provide benchmarks and control points for the project as follows:
- Existing control points and associated coordinates have been provided on the construction documents for each project site.
- Existing bench marks and descriptions have been provided on the construction documents for each project site. Contractor shall be responsible to re-establish bench marks necessary to complete his work.

Contractor shall be responsible for transferring benchmarks, control points, lines and grades as necessary to complete his work.

RECORD DRAWINGS
Maintain as-built drawings showing actual locations of utilities and other features encountered, modifications to proposed grades and site features, and other deviations from the original design.

PART 2 - MATERIALS

EARTH FILL
Granular soil free of particles larger than 3”, with less than 10% passing a number 200 sieve. The fill material shall be free of deleterious materials such as organics, snow, ice, sod, frozen soil and construction material.

GRANULAR FILL
Granular Fill shall consist of natural sand or a mixture of sand with gravel, crushed gravel, crushed stone or other broken or fragmented material, with less than 8% fines and a maximum aggregate size of 2”, meeting the gradation requirements of the Standard Specifications for Highway and Structure Construction, Section 209, Grade 1.
STRUCTURAL FILL
Clean material meeting the requirements of “Structure Backfill” as defined in Section 210.2.1 of the Standard Specifications for Highway Construction.

The Subsurface Soil Investigation Report indicates that onsite soils below the topsoil, if unsaturated, may be reused as structural fill.

BIO-RETENTION BASIN
Engineered Soil:

<table>
<thead>
<tr>
<th>Engineered Soil Component</th>
<th>Percentage Composition (by Volume)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral (SiO2) Sand</td>
<td>70-85%</td>
</tr>
<tr>
<td>Compost</td>
<td>15-30%</td>
</tr>
</tbody>
</table>

The sand shall meet one of the following gradation requirements:
- USDA Coarse Sand (.02 - .04 inches)
- ASTM C33 (Fine Aggregate Concrete Sand)
- Wisconsin Standards and Specifications for Highway and Structure Construction, Section 501.2.5.3.4. (Fine Aggregate Concrete Sand) 2005 edition, or an equivalent as approved by the administering authority.

The compost shall meet the requirements of S100 in the Wisconsin DNR Runoff Management Storm Water Technical Standards.

The sand component shall consist of mineral sand that is at least 97% SiO2. Substitutions, such as calcium carbonated sand, dolomitic sand, manufactured sand, or stone dust are not allowed. The sand shall be washed to removed clay and silt particles, and well-drained prior to mixing.

The engineered soil mix shall be free of rocks, stumps, roots, brush, or other material over 1 inch in diameter. No other material shall be mixed with the planting soil that may be harmful to plant growth to prove a hindrance to planting or maintenance. The engineered soil mix shall have a pH between 5.5 and 6.5.

The engineered soil mix shall have adequate nutrient content to meet plant growth requirements.

Sand Storage Layer: A layer of sand may be used in lieu of gravel to form the storage layer. The sand shall meet the specification identified above.

PART 3 - EXECUTION
GENERAL
Complete earthwork for structures, trenching and roadways in accordance with this section and the following applicable sections:
- Section 31 23 16.13 - Trenching
- Section 31 23 16.16 - Structure Excavation for Minor Structures
- Section 31 22 16.15 - Roadway Subgrade Preparation

Rock excavation shall be completed in accordance with Section 31 23 16.26 - Rock Removals.

TOPSOIL REMOVAL
Comply with erosion control requirements of Section 31 25 00 – Erosion Control relative topsoil removal and storage.

Complete clearing and grubbing work as required by the Contract Documents and as specified in Section 31-10-00- Site Clearing.
Coordinate topsoil stockpile locations with Owner and other contractors working onsite. Place silt fence around base of stockpiled topsoil.

Remove all topsoil from proposed locations of buildings, structures, roads, walks and other paved areas. Also, remove topsoil from proposed lawn or turf areas where the proposed elevation exceeds the existing elevation by 1’ or greater, or where fill will be placed.

Stockpile reusable topsoil for use in restoration. Salvaged topsoil shall not be removed from the site without prior approval of the Owner.

Do not excavate, grade or work topsoil in frozen or muddy condition.

Minimize compaction of topsoil to the extent possible.

**EXCAVATION**

Excavate to the elevations shown on the plans; allow for placement of fill, base course, pavements, and topsoil as required by the plans and other Contract Documents.

Transfer lines and grades provided by the Owner or A/E as necessary.

Excavate areas to provide positive drainage whenever possible.

Remove excess and spoil material from the site in a timely fashion.

Stockpile all boulders suitable for landscaping at a location designated by the Owner.

Do not excavate below design grades without prior authorization by the Owner.

**DEWATERING**

Provide equipment including pumps, piping, and temporary drains required to keep trenches dry during construction.

Do not discharge pumped water directly into municipal sewer systems without receiving prior approval. Ensure discharge water does not contain contamination or silt held in suspension.

Filter bags or screening shall be used in accordance with the Wisconsin Department of Natural Resources Technical Standard 1061.

Direct surface drainage away from excavated areas. Control grading in and adjacent to excavations to prevent water running into excavated areas or onto adjacent properties or public thoroughfares.

Furnish and operate pumping equipment on a twenty-four (24) hour basis, if needed, to keep excavated areas free of water until utilities have been placed and backfilled.

**PLACING AND COMPACTING MATERIAL**

Place material in fill areas only after all topsoil has been removed.

Place fill to the elevations shown on plans; allow for placement of base course, pavements and topsoil as required by the plans and other Contract Documents.

Fill type shall be as indicated on Table 31 20 00 -2, or as shown on the plans.
Do not place fill on areas consisting of organic soil, debris or other soft and yielding material.

Do not place fill on frozen or muddy areas.

Moisture condition subgrade as necessary to provide a firm surface prior to placing fill.

Place fill in horizontal lifts having thickness as shown on Table 31 20 00 -2.

Compact fill material as required by Table 31 20 00 -2 for given use.

Moisture condition fill material as necessary to achieve density required for given use.

Place and compact backfill so as to minimize settlement and avoid damage to walls, utility lines and other work in place. Place backfill simultaneously on both sides of free-standing structures.

It is the responsibility of the Contractor to provide all necessary compaction equipment and other grading equipment that may be required to obtain the specified compaction. Compaction of controlled backfill by travel of grading equipment will not be considered adequate for uniform compaction. Hand guided vibratory or tamping compactors will be required whenever controlled backfill may be placed adjacent to walls, footings, columns or in confined areas.

Accommodate and assist geotechnical consulting engineer in collecting and testing soil samples.

**Table 31 20 00-2**

<table>
<thead>
<tr>
<th>Location</th>
<th>Required Material</th>
<th>Maximum Compacted Lift Thickness</th>
<th>Minimum Proctor Compaction</th>
<th>Minimum Relative Density (a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Areas Beneath Footings, Floor Slabs, or Structures</td>
<td>Structural Fill</td>
<td>8”</td>
<td>95% Modified</td>
<td>70%</td>
</tr>
<tr>
<td>Footing, Foundation and Structure Backfill</td>
<td>Structural Fill</td>
<td>8”</td>
<td>95% Modified</td>
<td>70%</td>
</tr>
<tr>
<td>Areas within 10’ of Existing or Proposed Building or Structure Footing or Slab</td>
<td>Earth Fill</td>
<td>12”</td>
<td>90% Modified</td>
<td>60%</td>
</tr>
<tr>
<td>Areas Beneath Existing or Proposed Pavement (Roads, Drives, Walks)</td>
<td>Earth Fill</td>
<td>8”</td>
<td>90% Modified</td>
<td>60%</td>
</tr>
<tr>
<td>Turf Areas</td>
<td>Earth Fill</td>
<td>12”</td>
<td>85 % Modified</td>
<td>50%</td>
</tr>
</tbody>
</table>

(a) Minimum relative density as determined by ASTM D-4253-00 for coarse-grained soils with less than 15% by mass passing the No. 200 sieve. Applicable only when minimum proctor compaction cannot be achieved.

**GRADING AROUND TREES**

Limit excavation, fill or grading near trees or other vegetation to the extent possible. When tree roots are encountered, cut roots cleanly and squarely.
CLEAN UP

Level off all waste disposal areas and clean up all areas used for the storage of materials or the temporary deposit of excavated earth. Remove all surplus material, tools and equipment.

Thoroughly clean all drainage ways, roads, parking lots, sidewalks, and paved surfaces and remove and dispose of all debris and mud.

END OF SECTION
PART 1 - GENERAL

SCOPE
The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to complete trenching for utilities and other work, as required in these specifications, on the drawings and as otherwise deemed necessary to complete the work. Included are the following topics:

PART 1 - GENERAL
Scope
Related Work
Submittals
Record Drawings
Quality Assurance
Provisions for Future Work
Survey and Staking

PART 2 - MATERIALS
Crushed Stone Bedding
Crushed Stone Screenings
Bedding Sand
Cement Slurry Grout

PART 3 - EXECUTION
Preparation
Connections to Existing Utilities
Dewatering
Excavation
Bedding/Initial Cover
Backfill and Compaction
Restoration

RELATED WORK
Applicable provisions of Division 1 govern work under this Section.

Section 02 32 00 – Geo Technical Investigation
Section 31 25 00 – Erosion Control
Section 31 20 00 – Earthmoving
Section 33 40 00 – Storm Drainage Utilities

Applicable provisions of Division 1 shall govern all work under this section.

SUBMITALS
Provide copies of record drawings.

Provide samples of each type of soil or aggregate proposed for use on the project. Samples shall consist of a minimum of 50 pounds of soil. The contractor shall be responsible for delivering soil samples to the testing agency as designated by the Owner. Provide samples a minimum of 2 weeks prior to starting construction.

Provide copies of material testing reports.

RECORD DRAWINGS
Maintain record drawings showing actual locations of utilities and other features encountered, modifications to proposed grades and site features, and other deviations from the original design.

QUALITY ASSURANCE
The Contractor shall complete quality assurance testing as outlined in Table 31 23 16.13-1:
### Table 31 23 16.13-1

<table>
<thead>
<tr>
<th>Material</th>
<th>Test Required</th>
<th>Test/Sample Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trench Backfill</td>
<td>I.e. D2922-01 Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Methods</td>
<td>I.e. 1 test/300 lf trench</td>
</tr>
</tbody>
</table>

Trench backfill shall be tested for density in pavement areas. Trenches in turf areas shall be compacted according to the specifications, but density testing will not be required.

### SURVEY AND STAKING

- Contractor shall be responsible to perform all construction staking as necessary to complete his work.
- Prior to the start of demolition/work, re-establish control points as indicated on the construction documents.

Owner or A/E will provide benchmarks and control points for the project as follows:
- Existing control points and associated coordinates have been provided on the construction documents for each project site.
- Existing benchmarks and descriptions have been provided on the construction documents for each project site. Contractor shall be responsible to re-establish benchmarks necessary to complete his work.

Contractor shall be responsible for transferring benchmarks, control points, lines and grades as necessary to complete his work.

### PART 2 - MATERIALS

#### CRUSHED STONE BEDDING

Clean material meeting the requirements of “¾” Crushed Stone Chips” as defined in Section 6.43.2(a)2, regardless of pipe size, of Standard Specifications for Sewer and Water Construction.

#### CRUSHED STONE SCREENINGS

Crushed stone free of organic material, concrete, asphalt and other debris. Material shall meet the requirements of “Crushed Stone Screenings” as defined in Section 6.43.2(b) of Standard Specifications for Sewer and Water Construction.

#### BEDDING SAND

Sand meeting the requirements of “Bedding Sand” as defined in Section 6.43.2(c) of Standard Specifications for Sewer and Water Construction.

#### CEMENT SLURRY GROUT

Portland cement based grout having a slump of 10”-12” and the following mix proportion (per CY):

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1 Portland Cement</td>
<td>100#</td>
</tr>
<tr>
<td>Class C Fly Ash</td>
<td>300#</td>
</tr>
<tr>
<td>Fine Aggregate</td>
<td>2700#</td>
</tr>
<tr>
<td>Water</td>
<td>400#</td>
</tr>
<tr>
<td>Air Entraining Admixture</td>
<td>35 oz</td>
</tr>
</tbody>
</table>

Similar mix designs that are suitable for the intended use will be considered.

### PART 3 - EXECUTION

#### PREPARATION

Review plans and prepare work plan and schedule. Coordinate any necessary interruptions in utility service with Owner, in accordance with other specification sections.
SECTION 31 23 16.13
TRENCHING

1. Layout work. Establish and transfer line and grade as necessary to complete the work.

2. Remove topsoil from work area. Saw cut and remove pavement from the work area.

CONNECTIONS TO EXISTING UTILITIES
Connect to existing utilities in accordance with the requirements of other pertinent specification sections.

DEWATERING
Dewatering shall be completed in accordance with Section 31 20 00 - Earthmoving

EXCAVATION
Excavate to elevations and dimensions necessary to complete construction. Excavations shall be sufficiently deep to provide for bedding beneath pipes and structures.

For pipes less than 12” in diameter, maximum trench width at the top of the pipe shall be 3’. For pipes greater than 12” in diameter, the maximum trench width at the top of the pipe shall be no greater than the outside diameter of the pipe plus 2’.

The trench width at the ground surface shall be minimized to the extent possible through the use of trench boxes, shields, or shoring.

The trench width at the ground surface shall not exceed the width of the trench at the top of the pipe by more than 2’ without prior approval by the Owner.

Provide a minimum clearance of 6” from outside of pipe to the closest of either the sidewall of trench or inside wall of trench box, shield or shoring.

Notify Owner if trench subgrade consists of unstable soil, organic material, debris or other undesirable material.

Segregate the various materials excavated. Reserve material meeting the requirements of backfill for the location. Excavated material that does not meet the requirements of backfill, and excess excavated material, shall be removed from the site and disposed by the contractor, unless directed otherwise by other specification sections or the Owner.

Locate bedding, backfill and spoil piles in accordance with OSHA requirements, and so that it does not interfere with public travel, adjacent landowners or other construction activities.

Trench excavation shall be limited to that which can be excavated and backfilled within the same workday.

The same trench may obstruct no more than one street crossing at one time.

BEDDING/INITIAL COVER
Bed pipes and place initial cover material in accordance with detail drawings and the requirements of specifications for the utility and pipe type being installed.

Establish excavation subgrade in accordance with proposed utility lines and grades, allowing for required amount of bedding material.

Excavation shall be reasonably free of water prior to placement of bedding material.

Place bedding material to required depth, and compact to 95% Modified Proctor dry density.

Shape bedding material to conform to bell of pipe, fittings and structures.
After placing pipe, support during placement and compaction of initial cover material. Place cover material in lifts having a maximum thickness of 6”. Compact initial cover material to 95% Modified Proctor dry density.

Compaction of initial cover material for pipe and fittings shall be accomplished using hand tools and vibratory plate or tamping type walk behind compactors.

BACKFILL AND COMPACTION

Once initial cover material is placed and compacted, backfill trenches using on site material or as recommended by the geotechnical engineer.

Backfill trenches to elevations shown on the plans; allow for placement of base course, pavements, and topsoil as required by the plans and other Contract Documents. Where final restoration will be delayed, backfill trench to existing grade to provide a safe, free-draining surface.

Moisture condition backfill material as necessary to achieve density required for given use.

Do not place material on frozen surfaces or use frozen material.

Compact fill material as required by Table 31 23 16.13-2 for the given use. Compact material to minimize settlement and avoid damage to structures, pipes, utility lines and other features. Place backfill simultaneously on both sides of structures.

It is the responsibility of the Contractor to provide all necessary compaction equipment and other grading equipment that may be required to obtain the specified density. Vibratory plate or tamping type walk behind compactors will be required whenever backfill is placed adjacent to structures, pipes, utility lines and other features.

Flooding or jetting of backfill material for compaction purposes is not allowed.
Table 31 23 16.13-2

<table>
<thead>
<tr>
<th>Location</th>
<th>Required Material</th>
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</tbody>
</table>

\(^{(a)}\) Minimum relative density as determined by ASTM D-4253-00 for coarse-grained soils with less than 15% by mass passing the No. 200 sieve. Applicable only when minimum proctor compaction cannot be achieved.

**RESTORATION**

Restore trenches to proposed grades and surfaces as soon as practicable after backfilling.

Remove excess bedding, backfill and spoil material from the site as soon as possible after backfilling is complete, but no later than 1 calendar dates after backfilling is complete.

Thoroughly clean all drainage ways, roads, parking lots sidewalks and paved surfaces and remove and dispose all debris and mud.

**END OF SECTION**
SECTION 31 25 00
EROSION CONTROL

PART 1 - GENERAL

SCOPE
The work under this section consists of providing all work, materials, labor, equipment, and supervision necessary to provide and construct erosion control measures necessary to protect property and the environment. Included are the following topics:

PART 1 - GENERAL
Scope
Related Work
Submittals
Notice of Intent

PART 2 - MATERIALS
General
Silt Fence
Inlet Protection
Soil Stabilizers
Soil Tackifiers
Polymers
Anionic Polyacrylimides

PART 3 - EXECUTION
General
Grading and Earthwork
Drainage
Tracking Control
Maintenance

RELATED WORK
Applicable provisions of Division 1 govern work under this Section.
31 10 00 -- Site Clearing
31 20 00 -- Earthmoving
31 23 16.13 -- Trenching

Provide erosion control in accordance with the following references:

- Wisconsin Department of Natural Resources Technical Standards for Construction Site Erosion & Sediment Control (Technical Standards):
- Erosion Control Product Acceptability List ("PAL"), current version as published by the WDOT available at the following website: http://www.dot.wisconsin.gov/business/engrserv/pal.htm

Method of measurement and basis of payment sections in any referenced erosion control documents shall not apply to this contract.

SUBMITTALS
The Lead Contractor will submit the following to the A/E:
- Contractor shall mark-up of the Erosion Control Plan that is included in these documents showing additional or alternate erosion control measures as needed due to the Contractor’s means and methods throughout all phases of construction. The Contractor may also be required to submit calculations and backup information showing the proposed measures meet applicable regulations.
SECTION 31 25 00
EROSION CONTROL

- Submittals for materials used to implement the erosion control plan.

PART 2 - MATERIALS

GENERAL
Erosion mats, soil stabilizers, and tackifiers shall be listed on the Wisconsin Department of Transportation Product Acceptability List (PAL) or the Wisconsin Department of Natural Resources Technical Standards.

When the design or contract includes permanent erosion control or stormwater control features, the contractor may employ these items to control erosion and stormwater during construction activities. However, these features shall be fully cleaned and restored to the original design providing full function for the intended permanent use prior to acceptance of the work.

SILT FENCE
Silt Fence shall meet the requirements in Standard 1056 of the Wisconsin DNR Storm Water Management Technical Standards. Silt Fence shall have type “FF” geotechnical fabric, as defined by the Wisconsin Department of Transportation PAL.

INLET PROTECTION
Inlet Protection shall meet the requirements in Standard 1060 in the Wisconsin Storm Water Construction and Post-Construction Technical Standards. Inlet Protection shall have Wisconsin Department of Transportation PAL Type FF, geotextile fabric.

SOIL STABILIZERS
Soil stabilizers shall be non-asphalt-based products of the type specified, and meeting the requirements of the PAL.

SOIL TACKIFIERS
Soil tackifiers shall be non-asphalt-based products of the type specified, and meeting the requirements of the PAL.

POLYMERS
Polymers used to settle suspended sediment shall meet the requirements of the WDNR Technical Standards.

ANIONIC POLYACRYLAMIDE
Water soluble anionic polyacrylamide (PAM) used as temporary soil binding agents to reduce erosion shall meet the requirements of the WDNR Technical Standards.

PART 3 - EXECUTION

GENERAL
Install and maintain erosion control measures as required by the erosion control plan throughout phases of the project. Notify Owner of modifications to the erosion control plan as dictated by Contractor’s means and methods, construction phasing or by differing site conditions.

Contractor shall provide all erosion control measures necessary to prevent and manage polluted runoff from the construction site and discharge of sediment onto adjacent property, into storm sewers or waters of the state.

Install/use products in accordance with manufacturer's instruction where these specifications do not specify a higher requirement.
SECTION 31 25 00
EROSION CONTROL

GRADING AND EARTHWORK
Install temporary or permanent erosion control measures applicable to each phase of grading or land disturbance prior commencing on that phase.

Clear only those areas designated for the placement of improvements or earthwork before placement of the final cover. Perform stripping of vegetation, grading, excavation, or other land disturbing activities in phases to minimizing exposure of bare soil. Do not clear the site of topsoil, trees, and other natural ground covers before the commencement of construction. Retain natural vegetation and protect until the final ground cover is placed.

Do not stockpile soil within 25 feet of any roadway, parking lot, paved area, drainage structure, or channel. Provide temporary stabilization and erosion control measures on disturbed areas and soil stockpiles which will remain for a period of more than 7 consecutive calendar days.

Remove surplus excavation materials from the site immediately after rough grading.

DRAINAGE
Divert roof drainage and runoff from all undisturbed areas upslope of the site around disturbed areas. Minimize runoff on exposed soil. Provide measures to remove sediment, and debris.

Convey clean or treated runoff to the nearest adequate stormwater facility. Do not discharge water in a manner that will cause erosion or sedimentation of the site or receiving stormwater facility.

Protect storm sewer inlets and catch basins with inlet protection devices meeting the requirements of the WDNR Technical Standards and PAL.

Provide ditch checks in swales or ditches to reduce the velocity of water in the channel. Construct in accordance with WDNR technical standards and PAL.

Dewatering discharge shall be routed to a sedimentation basin or sedimentation vessel to reduce the discharge of sediments to meet the requirements of WDNR 151. Do not discharge water in a manner that will cause erosion or sedimentation of the site or receiving stormwater facility.

TRACKING CONTROL
Construct and maintain Tracking Pads in accordance with the DNR Technical Standards. Provide each entrance to the site with a stone tracking pad at least 50 feet in length with a minimum thickness of 12 inches. The tracking pad shall be the full width of the egress point. Inspect tracking pads on a daily basis and replace aggregate when no longer effective.

If necessary, provide a crushed aggregate paved parking area.

If applicable, wash water shall be discharged to sedimentation basins, sedimentation vessels, or other such control areas. Untreated wash water shall not be routed to storm sewers or waters of the state.

MAINTENANCE
Contractor shall inspect all erosion control measures within 24 hours of the end of each rainfall event that exceeds 0.5”, and as required by the Notice of Intent Permit.

Re-apply soil stabilizers, tackifiers, polymers and anionic polyacrylamides as needed to prevent erosion of exposed soil.
SECTION 31 25 00  
EROSION CONTROL

Maintain records of all inspections and any remedial actions taken on-site as required by the Notice of Intent Permit.

Remove any sediment reaching a public or private roadway, parking lot, sidewalk, or other pavement. Do not remove tracked sediments by flushing. Completely remove any accumulations not requiring immediate attention at least once daily at the end of the workday.

Frequently dispose of all waste and unused construction materials in licensed solid waste or wastewater facilities. Do not bury, dump, or discharge, any garbage, debris, cleaning wastes, toxic materials, or hazardous materials on the site, on the land surface or in detention basins, or otherwise allow materials to be carried off the site by runoff onto adjacent lands or into receiving waters or storm sewer systems.

END OF SECTION
SECTION 32 05 00
COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

SCOPE
This section provides information common to two or more technical site work specification sections or items that are of a general nature, and not included in other sections. This section applies to ALL site work, as applicable. Included are the following topics:

PART 1 - GENERAL
Scope
Related Work
Referenced Organizations
Referenced Documents
Quality Assurance
Safety
Construction Limits
Equipment & Materials Furnished by Others
Provisions for Future Work
Work by Others
Submittals
Off Site Storage
Codes
Certificates and Inspections

PART 2 - MATERIALS
Barricades, Signs, and Warning Devices
Temporary Plastic Barrier Fencing
Concrete Wheel Stops

PART 3 - EXECUTION
Maintenance of Site and Building Access/Egress
Continuity of Existing Traffic/Parking and Traffic Control
Protection and Continuity of Existing Utilities
Protection of Existing Work and Facilities
Stormwater/Excavation Water Management
Concrete Wheel Stops

RELATED WORK
Applicable provisions of Division 1 govern work under this Section.

REFERENCED ORGANIZATIONS
Applicable provisions of Division 1 shall govern all work under this section.

Abbreviations of organizations referenced in these specifications are as follows:

AASHTO American Association of State Highway and Transportation Officials
ACPA American Concrete Pipe Association
ANSI American National Standards Institute
ASCE American Society of Civil Engineers
ASME American Society of Mechanical Engineers
ASTM American Society for Testing and Materials
AWWA American Water Works Association
AWS American Welding Society
FHA Federal Highway Administration
EPA Environmental Protection Agency
SECTION 32 05 00
COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS

REFERENCED DOCUMENTS
Where reference is made to the "SSHSC", it shall mean the pertinent sections of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, and all supplemental and interim supplemental specifications. Where reference is made to the “SSSWC”, it shall mean pertinent sections of the Standard Specifications for Sewer and Water Construction in Wisconsin, current edition. Where reference is made to the “BMPH”, it shall mean the Wisconsin Construction Site Best Management Practice Handbook, current edition as published by the WDNR. Method of measurement and basis of payment sections in referenced documents shall not apply.

QUALITY ASSURANCE
Provide materials and products as required by individual specification sections. Refer to Section GC - General Conditions of the Contract regarding substitutions.

Provide quality assurance testing and reporting as required by individual specification sections.

SAFETY
Contractor is solely responsible for worksite safety.
Perform all work in accordance with applicable OSHA, state and local safety standards.
Contact Diggers Hotline at 1-800-242-8511 in accordance with statutory requirements. Request that non-member utilities and private utilities be located by the appropriate parties.

CONSTRUCTION LIMITS
Construction Limits are indicated on the drawings. In the absence of such a designation on the drawings, confine work to the minimum area reasonably necessary to undertake the work as determined by the Owner. In no case shall construction activities extend beyond state property lines or construction easements.
The Contractor shall restore all disturbed areas in accordance with the drawings and specifications. If plans and specifications do not address restoration of specific areas, these areas will be restored to pre-construction conditions as approved by the Owner.

WORK BY OTHERS
Coordinate work under this project with work by Owner and other contractors on the site.

SUBMITTALS
Refer also to Section GC - General Conditions of the Contract and Division 1.
Submit manufacturer's shop drawings, product data, samples, substitutions and operation and maintenance (O&M) data for approval as required by individual specification sections.
Unless otherwise noted, provide 6 copies of each submittal. Submit to project architect/engineer (A/E) unless otherwise directed by Owner at the Pre-Construction Meeting.
SECTION 32 05 00
COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS

OFF SITE STORAGE
Refer to Division 1.

In general, the payments for materials stored off site will only be considered in instances where there is limited space available for storage on the site. Prior approval by the Owner, together with the execution of a Storage Agreement will be required.

CODES
Comply with the requirements of all applicable, local, state and federal codes.

CERTIFICATIONS AND INSPECTIONS
Refer to Section GC - General Conditions.

Obtain and pay for all required sampling, testing, inspections, and certifications except those expressly listed as provided by the A/E or other third party in the Contract Documents. Deliver originals of certificates and documents to the Owner w/1 3 days; provide copies to the A/E. Include copies of the certifications and documents in the O&M Manual.

PART 2 - MATERIALS

BARRICADES, SIGNS, AND WARNING DEVICES
Traffic barricades, traffic signs, and warning devices shall meet the requirements of applicable OSHA standards and the FHA Manual of Uniform Traffic Control Devices (MUTCD).

TEMPORARY PLASTIC BARRIER FENCING
UV stabilized high-density polyethylene barrier fence free of holes tears and other defects. Provide 4’ tall fence in diamond or rectangular pattern. Fencing shall be “safety orange” color, unless otherwise noted.

Posts for temporary plastic barrier fencing shall be 5’ tall, minimum 12 gauge, painted metal posts.

PART 3 - EXECUTION

MAINTENANCE OF SITE AND BUILDING ACCESS/EGRESS
Unless otherwise shown or directed, maintain existing access and egress to the facility throughout construction. Maintain ANSI A117 compliant access for disabled persons, delivery access, emergency vehicle access, and emergency egress. Do not interrupt access and egress without prior written approval from the Owner.

CONTINUITY OF EXISTING TRAFFIC/PARKING AND TRAFFIC CONTROL
Do not interrupt or change existing traffic, delivery, or parking on neighboring streets without prior written approval from the local municipality and Owner. When interruption is required, coordinate schedule with the Owner agency to minimize disruptions. When Contractor’s activities impede or obstruct traffic flow, Contractor shall provide traffic control devices, signs and flaggers in accordance with other Contract Documents and the current version of the MUTCD, or as shown on the Drawings.

PROTECTION AND CONTINUITY OF EXISTING UTILITIES
Verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric, telephone/communication, fuel, steam lines or other utilities and site features which may be encountered in any excavations or other sitework. All lines shall be properly underpinned and supported to avoid disruption of service.

Do not interrupt or change existing utilities without prior written approval from the Owner, affected utilities and users. Notify all users impacted by outages a minimum of 48 hours in advance of outage. Notification
shall be provided in writing and describe the nature and duration of outages and provide the name and number
of Contractor’s foreman or other contact.

Any service connections encountered which are to be removed shall be cut off at the limits of the excavation
and capped in accordance with the requirements of applicable codes and any specifications governing such
removals.

PROTECTION OF EXISTING WORK AND FACILITIES
Verify the locations of, and protect, any signs, paved surfaces, buildings, structures, landscaping, streetlights,
utilities, and all other such facilities that may be encountered or interfered with during the progress of the work.
Take measures necessary to safeguard all existing work and facilities that are outside the limits of the work or
items that are within the construction limits but are intended to remain. Report any damage to existing facilities
to the Owner immediately. Correct and pay for all damages.

STORMWATER/EXCAVATION WATER MANAGEMENT
Control grading around structures, pitch ground to prevent water running into excavated areas.
Pits, trenches within building lines and other excavations shall be maintained free of water.
Provide trenching, pumping, other facilities required.
Notify Architect/Engineer if springs or running water are encountered in excavation; provide discharge by
trenches, drains, pumping to point outside of excavation. Provide information to Architect/Engineer of points
and areas that water will be discharged. At the Engineer's option, the Contractor shall drain the spring to the
storm sewer system by the use of field tile.
Be responsible for control measures to prevent damage from flooding, erosion, and sedimentation to on-sitEand
off-site areas.

END OF SECTION
PART 1 - GENERAL

SCOPE

The work under this section consists constructing a dense graded base using crushed stone or crushed gravel. The contractor may also use crushed concrete, reclaimed asphaltic pavement, reprocessed material, or blended material with approval of the Owner.

PART 2 - MATERIALS

PART 3 - EXECUTION

REFERENCE

Wherever WisDOT or SSHSC appears in this specification it shall be construed to mean the pertinent sections of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction (SSHSC), current edition, and all supplemental and interim supplemental specifications, as they may pertain, except this contract shall be a lump sum contract and measurement and basis of payment methods shall not apply.

Applicable provisions of Division 1 shall apply to this section.

CONTINUITY OF EXISTING TRAFFIC, PARKING, AND UTILITIES

Do not interrupt or change existing traffic, delivery, or parking on neighboring streets without prior written approval from the local municipality and Owner. When interruption is required, coordinate schedule with the Owner agency to minimize disruptions.

When Contractor’s activities impede or obstruct traffic flow, Contractor shall provide traffic control devices, signs and flaggers in accordance with other Contract Documents and the current version of the MUTCD, or as shown on the Drawings.

PROTECTION OF EXISTING WORK AND FACILITIES

The Contractor shall verify the locations of, and protect, any signs, adjacent paved surfaces, buildings, structures, landscaping, lights, utilities, and all other such facilities that may be encountered or interfered with during the progress of the work. The contractor shall take measures necessary to safeguard existing work and facilities which are outside the limits of the work or items which are within the construction limits but are intended to remain.

The contractor shall coordinate his work and access to the site with the work and access requirements of all other contractors prior to the start of work -- especially when such work will connect to, or be connected to, other work.
SECTION 32 11 23. 33
DENSE GRADED BASE

PART 2 - MATERIALS

GENERAL
Use dense graded base (1 1/4”-inch). Materials shall conform to Section 301.2 of the WisDOT Standard Specifications for Highway and Structure Construction. Material gradations shall conform to Section 305.2.2 of the WisDOT Standard Specifications for Highway and Structure Construction unless specified elsewhere in the contract documents.

PART 3 - EXECUTION

CONSTRUCTION

Preparing the Foundation
Prepare the foundation, or resurface the previously placed base layer, as specified in WisDOT Section 211 before placing base. Do not place base foundations that are soft, spongy, or covered by ice or snow. Water and rework or re-compact dry foundations as necessary to ensure proper compaction, or as the Owner designates.

Proof-roll all subgrade areas that are to receive aggregate base or pavement. Proof-roll with a loaded dump truck prior to the placement of base courses to locate soft spots that yield under loading. Over-excavate (undercut) areas of soft subgrade that will not compact readily when proof rolled or tamped. Backfill with breaker run or select crushed material as approved by the Owner.

Stockpiling
If continuous compliance with material specifications is questionable, the Owner may require the contractor to supply material from a stockpile of previously tested material. Maintain a sufficiently large stockpile to preclude the use of material not previously approved.

Build and maintain stockpiles using methods that minimize segregation and prevent contamination. If the contract specifies location, place stockpiles where specified. Clear and prepare stockpile areas to facilitate the recovery of the maximum amount of stockpiled material.

Constructing Base
Place aggregate in a manner that minimizes hauling on the subgrade. Do not use vehicles or operations that damage the subgrade or in-place base. Deposit material in a manner that minimizes segregation.

Construct the base to the width and section the plans show. Shape, and compact the base surface to within 0.04 feet of the plan elevation.

Ensure there is adequate moisture in the aggregate during placing, shaping, and compacting to prevent segregation and achieve adequate compaction.

Maintain the base until paving over it, or until the Owner accepts the work, if paving is not part of the contract. The contractor is not responsible for maintaining material placed on detours, unless the special provisions specify otherwise.

Standard Compaction
Compact the base until there is no appreciable displacement, either laterally or longitudinally, under the compaction equipment. Route hauling equipment uniformly over previously placed base. Compact each layer before placing a subsequent layer. If the material is too dry to readily attain the required compaction, add water as necessary to achieve compaction.

Special Compaction
If the contract requires special compaction, compact each layer to 95 percent of maximum density, or
more, before placing the subsequent layer. The Owner will determine the maximum density according to AASHTO T 99 method C or D and in-place density according to AASHTO T 191.

Controlling Dust
Apply water or other engineer-approved dust control materials to control dust during construction and maintenance of the base and shoulders.

COMPACTION
General
Compact each base layer, including shoulder foreslopes, with equipment specified in WisDOT Section 301.3.1. Use standard compaction conforming to WisDOT Section 301.3.4.2, unless the special provisions specify other methods. Final shaping of shoulder foreslopes does not require compaction.

Compacting 1 1/4-Inch Base
If using a pneumatic roller, do not exceed a compacted thickness of 6 inches per layer. For the first layer placed over a loose sandy subgrade, the contractor may, with the Owner’s approval, increase the compacted layer thickness to 8 inches. If using a vibratory roller, do not exceed a compacted thickness of 8 inches per layer.

CLEANUP
After the project is completed, thoroughly clean up all debris which may have accumulated during the placement of dense graded base. Replace or repair as required, all surfaces and/or landscape features damaged or disturbed under this item of work.

END OF SECTION
SECTION 32 92 19
SEEDING

PART 1 - GENERAL

SCOPE
The work under this section shall consist of providing all work, materials, labor, equipment and supervision necessary to complete seeding, mulching and maintenance as indicated on the drawings. Included are the following topics:

PART 1 - GENERAL
Scope
Related Work
Submittals
Delivery, Storage and Handling
Planting Season
Guarantee

PART 2 - MATERIALS
Grass Seed
Grass Seed Mix
Water
Mulch

PART 3 - EXECUTION
Preparation
Sowing
Seeding Rates
Mulching
Cleaning and Repair
Maintenance Watering
Mowing

RELATED WORK
Applicable provisions of Division 1 govern work under this Section.
Section 31 25 00 – Erosion Control

SUBMITTALS
Provide seed samples and data showing seed mix composition and a guarantee of germination.
Provide seed mixture.
Provide anticipated planting dates.
Provide information on method of sowing seed.

DELIVERY, STORAGE AND HANDLING
Seed shall be delivered to the site in its original, unopened container, labeled as to weight, analysis, and manufacturer. Store any seed delivered prior to use in a manner safe from damage from heat, moisture, rodents, or other causes. Any seed damaged after acceptance shall be replaced by the Contractor.

PLANTING SEASON
The regular seeding season is considered May 1-June 30 and September 1-October 31. A dormant seed type shall be used when soil temperature is consistently below 53°F.

GUARANTEE
The Contractor shall guarantee the germination of seed installed during the regular seeding season.
PART 2 - PRODUCTS

GRASS SEED
Grass seed shall meet the requirements of Section 630.2.1 of Standards Specifications for Highway Construction.

GRASS SEED MIX
Unless otherwise indicated, provide Seed Mix No. 40, as defined in Section 630.2.1.5.1.1.2 of Standard Specifications for Highway Construction.

WATER
Water free of wastewater effluent or other hazardous chemicals.

MULCH
Clean straw or hay that is well-seasoned, and free of rot, mildew and the seeds of noxious weeds.

PART 3 - EXECUTION

PREPARATION
Prepare area in accordance with Section 32 91 13 – Soil Preparation.
No seeding shall occur on frozen ground or at temperatures lower than 32° F (0° C).

SOWING
Sow seed using either Method A or Method B as defined in Section 630.3.3 of Standard Specifications for Highway Construction. Unless otherwise noted, sow seed at a rate of 2# (dry seed weight)/1000 square feet.

SEEDING RATES
Use the following seed rates for seeds in pounds per 1000 square feet of area: ¼ lb per 1000 square feet. (approximately 8-10 lb per acre).

MULCHING
Place and anchor mulch using the methods outlined in Section 627.3 of Standard Specifications for Highway Construction.

CLEANING AND REPAIR
Waste and excess material from the seeding operation shall be promptly removed. Adjacent paved areas are to be cleaned, and any damage to existing adjacent turf areas shall be repaired.

MAINTENANCE WATERING
Seeded areas are to be watered daily to maintain adequate surface soil moisture for proper seed germination. Watering shall continue for not less than 30 days following seeding. Thereafter, apply 1/2” (1.3 cm) of water twice weekly until final acceptance.

MOWING
Cool season grasses, such as bluegrass, tall fescue, perennial ryegrass, etc. shall be mown to a height of 2-1/2” (6.4 cm) in spring and fall, and no less than 3” (7.6 cm) from June through September. These heights are to be maintained through repeat mowings as needed until final acceptance.
No more than 40% of grass leaf shall be removed during any single mowing operation. The mowing operation is to include trimming around obstacles and the raking of excess grass clippings. Weed eaters shall not be used around trees.

END OF SECTION
SECTION 33 05 00
COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

SCOPE
This section provides information common to two or more technical site work specification sections or items that are of a general nature, and not included in other sections. This section applies to ALL site work, as applicable. Included are the following topics:

PART 1 - GENERAL
Scope
Related Work
Reference
Referenced Organizations
Referenced Documents
Quality Assurance
Safety
Permits
Construction Limits
Work by Others
Submittals
Off Site Storage
Codes
Certificates and Inspections
Operation and Maintenance Data

PART 2 - MATERIALS
Barricades, Signs, and Warning Devices
Temporary Plastic Barrier Fencing

PART 3 - EXECUTION
Maintenance of Site and Building Access/Egress
Continuity of Existing Traffic/Parking and Traffic Control
Protection and Continuity of Existing Utilities
Protection of Existing Work and Facilities
Stormwater/Excavation Water Management
Agency Training

REFERENCE
Applicable provisions of Division 1 govern work under this Section.

REFERENCED ORGANIZATIONS
Applicable provisions of Division 1 shall govern all work under this section.

Abbreviations of organizations referenced in these specifications are as follows:

AASHTO American Association of State Highway and Transportation Officials
ACP American Concrete Pipe Association
ANSI American National Standards Institute
ASCE American Society of Civil Engineers
ASME American Society of Mechanical Engineers
ASTM American Society for Testing and Materials
AWWA American Water Works Association
AWS American Welding Society
FHA Federal Highway Administration
EPA Environmental Protection Agency
NEC National Electric Code
NEMA National Electrical Manufacturers Association
NFPA National Fire Protection Association
REFERENCED DOCUMENTS
Where reference is made to the "SSHSC", it shall mean the pertinent sections of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, and all supplemental and interim supplemental specifications. Where reference is made to the “SSSWC”, it shall mean pertinent sections of the Standard Specifications for Sewer and Water Construction in Wisconsin, current edition. Where reference is made to the “BMPH”, it shall mean the Wisconsin Construction Site Best Management Practice Handbook, current edition as published by the WDNR. Method of measurement and basis of payment sections in referenced documents shall not apply.

QUALITY ASSURANCE
Provide materials and products as required by individual specification sections. Refer to Section GC - General Conditions of the Contract regarding substitutions.

Provide quality assurance testing and reporting as required by individual specification sections.

SAFETY
Contractor is solely responsible for worksite safety.

Perform all work in accordance with applicable OSHA, state and local safety standards.

Contact Diggers Hotline at 1-800-242-8511 in accordance with statutory requirements. Request that non-member utilities and private utilities be located by the appropriate parties.

PERMITS
Unless otherwise noted in the Contract Documents, Contractor shall be responsible for obtaining and paying for all permits necessary to complete the work.

CONSTRUCTION LIMITS
Construction Limits are indicated on the drawings. In the absence of such a designation on the drawings, confine work to the minimum area reasonably necessary to undertake the work as determined by the Owner. In no case shall construction activities extend beyond state property lines or construction easements.

The Contractor shall restore all disturbed areas in accordance with the drawings and specifications. If plans and specifications do not address restoration of specific areas, these areas will be restored to pre-construction conditions as approved by the Owner.

WORK BY OTHERS
Coordinate work under this project with work by Owner and other contractors on the site.

SUBMITTALS
Refer also to Section GC - General Conditions of the Contract and Division 1.

Submit manufacturer’s shop drawings, product data, samples, substitutions and operation and maintenance (O&M) data for approval as required by individual specification sections.

Unless otherwise noted, provide 6 copies of each submittal. Submit to project architect/engineer (A/E) unless otherwise directed by Owner at the Pre-Construction Meeting.
SECTION 33 05 00
COMMON WORK RESULTS FOR UTILITIES

OFF SITE STORAGE
Refer to Division 1.

In general, the payments for materials stored off site will only be considered in instances where there is limited space available for storage on the site. Prior approval by the Owner, together with the execution of a Storage Agreement will be required.

CODES
Comply with the requirements of all applicable, local, state and federal codes.

CERTIFICATIONS AND INSPECTIONS
Refer to Section GC - General Conditions.

Obtain and pay for all required sampling, testing, inspections, and certifications except those expressly listed as provided by the A/E or other third party in the Contract Documents. Deliver originals of certificates and documents to the Owner w/i 3 days; provide copies to the A/E. Include copies of the certifications and documents in the O&M Manual.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - MATERIALS

BARRICADES, SIGNS, AND WARNING DEVICES
Traffic barricades, traffic signs, and warning devices shall meet the requirements of applicable OSHA standards and the FHA Manual of Uniform Traffic Control Devices (MUTCD).

TEMPORARY PLASTIC BARRIER FENCING
UV stabilized high-density polyethylene barrier fence free of holes tears and other defects. Provide 4’ tall fence in diamond or rectangular pattern. Fencing shall be “safety orange” color, unless otherwise noted.

Posts for temporary plastic barrier fencing shall be 5’ tall, minimum 12 gauge, painted metal posts.

PART 3 - EXECUTION

MAINTENANCE OF SITE AND BUILDING ACCESS/EGRESS
Unless otherwise shown or directed, maintain existing access and egress to the facility throughout construction. Maintain ANSI A117 compliant access for disabled persons, delivery access, emergency vehicle access, and emergency egress. Do not interrupt access and egress without prior written approval from the Owner.

CONTINUITY OF EXISTING TRAFFIC/PARKING AND TRAFFIC CONTROL
Do not interrupt or change existing traffic, delivery, or parking on neighboring streets without prior written approval from the local municipality and Owner. When interruption is required, coordinate schedule with the Owner agency to minimize disruptions.

When Contractor’s activities impede or obstruct traffic flow, Contractor shall provide traffic control devices, signs and flaggers in accordance with other Contract Documents and the current version of the MUTCD, or as shown on the Drawings.
SECTION 33 05 00  
COMMON WORK RESULTS FOR UTILITIES

PROTECTION AND CONTINUITY OF EXISTING UTILITIES
Verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric, telephone/communication, fuel, steam lines or other utilities and site features which may be encountered in any excavations or other sitework. All lines shall be properly underpinned and supported to avoid disruption of service.

Do not interrupt or change existing utilities without prior written approval from the Owner, affected utilities and users. Notify all users impacted by outages a minimum of 48 hours in advance of outage. Notification shall be provided in writing and describe the nature and duration of outages and provide the name and number of Contractor’s foreman or other contact.

Any service connections encountered which are to be removed shall be cut off at the limits of the excavation and capped in accordance with the requirements of applicable codes and any specifications governing such removals.

PROTECTION OF EXISTING WORK AND FACILITIES
Verify the locations of, and protect, any signs, paved surfaces, buildings, structures, landscaping, streetlights, utilities, and all other such facilities that may be encountered or interfered with during the progress of the work. Take measures necessary to safeguard all existing work and facilities that are outside the limits of the work or items that are within the construction limits but are intended to remain. Report any damage to existing facilities to the Owner immediately. Correct and pay for all damages.

STORMWATER/EXCAVATION WATER MANAGEMENT
Control grading around structures, pitch ground to prevent water running into excavated areas.

Pits, trenches within building lines and other excavations shall be maintained free of water.

Provide trenching, pumping, other facilities required.

Notify Architect/Engineer if springs or running water are encountered in excavation; provide discharge by trenches, drains, pumping to point outside of excavation. Provide information to Architect/Engineer of points and areas that water will be discharged. At the Engineer's option, the Contractor shall drain the spring to the storm sewer system by the use of field tile.

Be responsible for control measures to prevent damage from flooding, erosion, and sedimentation to on-site and off-site areas.

END OF SECTION
PART 1 - GENERAL

SCOPE

The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide for the storm sewer work required in these specifications and on the drawings. This specification shall apply to all storm sewer work beginning at a point 5’ outside of the building wall, unless otherwise specified. Included are the following topics:

PART 1 - GENERAL
Scope
Related Work
Reference
Reference Standards
Submittals
Record Drawings

PART 2 - MATERIALS
General
Pipe
Reinforced Concrete Pipe
PVC Pipe
HDPE Solid Wall Pipe
HDPE Corrugated Wall Pipe
Connections for Dissimilar Pipe Materials
Manholes
Inlets
Round Catch Basins
Castings
Apron Endwalls
Pipe Insulation
Locator Tape

PART 3 - EXECUTION
Notification
Laying Pipe
Bedding/Initial Cover
Structures (Manholes, Inlets, Round Catch Basins)
Apron Endwalls
Casting Installation
Connections to Existing Structures
Sewer Laterals
Pipe Insulation
Leakage Testing
Construction Verification Items

RELATED WORK
Section 01 91 01 – Commissioning Process
31 20 00 – Earthmoving
31 23 16.13 – Trenching

REFERENCE
Applicable provisions of Division 1 shall govern all work under this section.
REFERENCE STANDARDS
Where these specifications do not cover portions of the work to be undertaken, the Standard Specifications for Sewer and Water Construction in Wisconsin, current edition, shall govern the work.

American Society for Testing and Materials (ASTM):

- C76-05b Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
- C443-05a Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- C507-05a Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
- C877-02e1 Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
- D2680-01 Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
- D3034-04a Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- D3350-05 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
- D4673-02 Standard Classification System for Acrylonitrile-Butadiene-Styrene (ABS) Plastics and Alloys Molding and Extrusion Materials
- F477-02e1 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F679-03 Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

American Water Works Association (AWWA):
C104/ANSI A21.4-95 Standard For Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

C111/A21.11-00 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

C151/ANSIA21.53-00 Standard for Ductile Iron Pipe, Centrifugally Cast for Water or Other Liquids

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M252 Corrugated Polyethylene Drainage Pipe

AASHTO M294 Corrugated Polyethylene Pipe, 12- to 48-in Diameter

SUBMITTALS

Provide manufacturers product information (cut sheets), shop drawings and O&M information for storm sewer materials including:

- Pipe
- Fittings
- Structures
- Outfalls
- Castings

Provide reports documenting any required testing.

Provide copies of record drawings.

RECORD DRAWINGS

Refer to Section GR - General Requirements.

Maintain record drawings that show the actual locations, sizes and types of utilities and other features encountered.

Note any modifications to proposed sewer system size, location or elevation. Record any other deviations from the drawings.

PART 2 - MATERIALS

GENERAL

Conform all materials to the size and type shown on the plans or as called for in the specifications and to applicable Laws, Codes, and Ordinances.

All products and materials are to be new, undamaged, clean, and in good condition. Existing products and materials are not to be reused unless specifically indicated.

Be responsible for the safe storage and handling of all materials utilized in the work. Store all materials in areas designated by the Construction Representative in cooperation with the Owner.

Perform all work in accordance with any applicable manufacturer's instructions.

PIPE

Culvert and storm sewer pipe shall meet the specifications below. Reinforced concrete, PVC, and HDPE corrugated wall pipe are all acceptable.

Use only pipe supplied from the same manufacturer, and of the same type, unless otherwise specified or approved in advance by the Engineer.
When applicable, only pipe, joints, material and installation approved by Wisconsin Department of Natural Resources and/or the Department of Commerce for the intended use in the State of Wisconsin shall be used.

**REINFORCED CONCRETE PIPE**
Pipe and fittings shall conform to ASTM C-76 for circular pipe, minimum Class III. Joints for reinforced concrete pipe shall be bell and spigot or tongue and groove. Joints shall be provided with rubber gaskets conforming to ASTM C433.

**PVC PIPE**
Conform to ASTM D-3034 with solvent weld or elastomeric joints. Pipe shall be SDR-35, unless otherwise noted. Pipe over 15 inches in diameter shall meet the requirements of ASTM F679-03. Do not mix different manufacturer's products, or fittings.

**HDPE CORRUGATED WALL PIPE**
Corrugated pipe with an integrally formed smooth liner. Pipes with diameters 12”-36”, shall meet the requirements of ASTM F2306, AASHTO M-294, Type S. Joints for fittings and pipe shall be soil-tight bell and spigot, provided with rubber gasket. Rubber gasket shall be installed by the pipe manufacturer.

**PERFORATED UNDERDRAIN**
Perforated underdrain storm sewer pipe with diameters less than 10” may use any of the pipe materials below unless specifically identified on the plan. Underdrain shall be wrapped with a geotextile fabric of knitted, woven, or non-woven fibers of polyester, polypropylene, stabilized nylon, polyethylene, or polyvinylidene chloride. Do not use slit film woven fabrics. Fabric shall have a minimum grab tensile strength of 35 lb (ASTM D-46320), an apparent opening size No. 30-200 (ASTM D-4751), and a minimum permittivity of 1.35 s⁻¹.

High-density Polyethylene (HDPE) pipe conforming to AASHTO M252, type CP.
Polyvinyl Chloride (PVC) pipe for underdrains conforming to ASSHTO M278.

**CONNECTIONS FOR DISSIMILAR PIPE MATERIALS**
Where new sewer connects to and existing dissimilar pipe, the connection shall be made with a no hub type couplings meeting the requirements of CISPI 310. Couplings shall have neoprene gaskets with stainless steel shield, and multiple stainless steel clamps with worm gear tightening device. The couplings shall be made specifically for the type and size of pipe materials being connected. Couplings shall be Fernco Husky or approved equal.

**ROUND CATCH BASINS**
General
Round catchbasins shall be 36” inside diameter precast concrete unless otherwise shown or required.
Submit manufacturer's preproduction (shop) drawings for approval prior to the start of manufacturing.
Contractor shall carefully locate all pipe locations, sizes, orientation and elevation prior to ordering catchbasin.
Round catchbasins shall meet the requirements of ASTM C478.
Pre-cast catchbasin wall thickness shall be minimum of 4”.
Provide 6” thick pre-cast catchbasin base. Catchbasin bottom section may be pre-cast with integral base. Catchbasins shall be provided with precast reinforced concrete in-bell cover designed to accommodate AASHTO H20 loading. In-bell cover shall be provided with 24” opening for casting.
SECTION 33 40 00
STORM DRAINAGE UTILITIES

Joints
Catchbasins requiring separate base and riser sections, must be provided with standard pipe tongue and groove joints.

Seal joints watertight with prefabricated rubber or plastic gaskets or formed in place butyl rubber seal.

Joint sealers: Kent Seal, ConSeal, or approved equal.

Connections
Provide custom knock-outs/cut-outs based on project and location specific conditions.

A minimum of 2” of the precast structure is required between the top of a knock-out/cut-out and the top of the structure. A minimum of 2” of precast structure is required between the side of a knock-out/cut-out and the inside face of an adjacent sidewall.

Flowline
Provide either pre-cast or cast-in-place flowline that provides positive flow through the structure. Provide bench that directs water towards the flowline.

Flowlines and benches shall be formed with gradual, uniform sweeps directed towards the downstream pipe. Provide smooth, troweled finish for flowlines.

Adjusting Rings
Fiber-reinforced pre-cast concrete adjusting rings meeting the requirements of ASTM C-478. Provide rings of 2” or 4” thickness.

Precompressed butyl gasket , 3/8”x3 ½” shall be used between the top of the catchbasin and first adjustment ring, and between all subsequent rings. Butyl material shall be E-Z Stick, or equal.

CASTINGS
General
All castings shall be heavy duty iron conforming to ASTM A48, Class 20 and rated for AASHTO H-20 loading. Provide non-rocking or machined castings with concealed pickhole.

All casting shall be as specified in the construction documents manhole schedule. Equivalent castings may be used if product data is submitted to and approved by Engineer.

TRACER WIRE
A tracer wire shall be installed in accordance with all of the following:

- Tracer wire shall be installed along the length of the non-metallic pipe.
- Tracer wire shall be a minimum of 18 gauge, 0.015” thick vinyl insulated (color green), single-conductor copper wire or equivalent.
- Tracer wire shall be located directly above and within 6 inches of the non-metallic pipe.
- Tracer wire shall be accessible and locatable within the owner’s property at 400-foot intervals or increments thereof.
- Exterior access locations shall include a means of protecting the tracer wire.

PART 3 - EXECUTION

NOTIFICATION
Contractor, prior to excavation work, shall notify all utilities, governmental agencies, or entities, known to, or which can reasonably be assumed to, have above or below ground pipe, conduit cables, structures or similar items within limits of project, to locate and mark location of such items. The Contractor shall expose potential pipe conflicts prior to installation of sewers to allow for any field changes to the design to be made.
LAYING PIPE
Install all pipe in accordance with ASTM specifications which pertain to the specified type of pipe material and the installation situation.

Do not use any pipe or fittings cracked in cutting or handling or otherwise not free from defects.

Clean all pipe of any dirt and/or debris both inside and out prior to placing in the trench.

Make joints in accordance with manufacturer's directions with due care to avoid damaging pipe and/or disturbing previously laid pipe.

Cut pipe only according to manufacturer's directions.

Lay all sewer pipes to horizontal alignment and grade shown on the plans with bell ends up hill. Establish and maintain horizontal alignment using total station, transit or theodolite. Use pipe laser or level to establish and maintain grade of pipe. Discrepancies from the required horizontal alignment or grade at any location shall not be greater than 0.10' or 0.05', respectively.

Do not exceed specified trench widths.

BEDDING/INITIAL COVER
Provide bedding and initial cover in accordance with the applicable requirements of Section 31 23 16.13 – Trenching.

Storm sewer and sewer services shall be provided with 4” of bedding material and 12” of initial cover material (both measured at the bell of the pipe). Crushed Stone Bedding shall be used for both bedding and initial cover.

STRUCTURES (MANHOLES, INLETS, ROUND CATCH BASINS)
Contractor shall determine the proper location, size, elevation, and orientation of all pipes entering new structures before ordering. Do not connect abandoned pipes to new structures. Structures having improper location and/or orientation of the pipe connections will be rejected. Field repairs or adjustments of connection points are not permitted.

Limit the excavation for structures so as to provide only the necessary amount of space to sufficiently prepare the subgrade, set the base, set the structure, and lay pipe. Provide a minimum of 1’ of clearance between structure and trench wall for adequate backfilling and compaction.

Where excavation occurs below the bottom elevation of the structure's base, bring the excavation to the required elevation by the use of compacted crushed stone bedding. A minimum of 8 inches of compacted Crushed Stone Bedding shall be placed below the bottom of the structure base.

Set structure base in accordance with elevation and location as indicated on the plans. Install base plumb and level. Install subsequent pre-cast sections in accordance with shop drawing layout. Provide watertight gaskets between each section.

Pour inverts with smooth surface draining to downstream pipe. Where two or more lines meet at an angle, provide curved channel. Slope bench or floor at 2 inches/ft towards flow channel.

Structures shall be provided with between 4” and 8” of adjusting rings, with the top adjusting ring being 2” thick. Provide butyl sealant material between rings. Once rings are in place, tuck point the exterior joint and provide the entire exterior surface of the adjusting ring riser with a coating of mortar.
CASTING INSTALLATION
Install casting type as indicated on the plans or in the specifications. Correctional and mental health facilities shall be provided with Security Castings.

Provide butyl sealant material between last adjusting ring and casting base. Adjust casting elevation and slope to match adjacent proposed grades.

CONNECTIONS TO EXISTING STRUCTURES
Make all necessary openings into existing structures or sewers including the reconstruction of existing inverts or benches, as necessary. Patch all openings permanently watertight with concrete brick and mortar, hydraulic cement, or flexible watertight boots.

SEWER LATERALS
Connect existing sewer laterals in accordance with all of the requirements of the sewer mains, including bedding, backfill, compaction, and jointing of the pipe. Connect sewer laterals to the sewer main by means of an approved "wye" fitting. Connect the new pipe to the existing lateral material using a no-hub coupling or approved transition fitting. Coupling/fitting shall be selected for the specific pipe material being connected.

Subject to local municipality requirements, cut-in type saddle wyes are permitted on existing sanitary sewers where service laterals are to be connected to the sewer. Unless otherwise indicated, the saddle fitting shall be gasketed PVC, with stainless steel bands and hardware.

PIPE INSULATION
Provide insulation when indicated on the drawings. Unless otherwise noted, install 2” thick polystyrene boards insulation.

Install insulation on compacted initial cover material, 6” above the top of the pipe. Stagger joints where more than one layer of insulation is required. Provide insulation with a minimum of 1’ of initial cover material. Place cover and backfill material in manner that does not damage insulation; replace any damaged insulation.

LEAKAGE TESTING
Storm sewers shall be visually inspected for excessive water infiltration and soil leakage into sewers or structures. Contractor shall repair/correct any infiltration or soil leakage that is considered excessive by the Owner.

END OF SECTION