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FOR:
Northeastern Wayne School Corporation
Early Childhood Center

Engineers / Architects:
Stair Associates, Inc.
9641 Commerce Dr.
Carmel, IN 46032
Office: 317-228-1900
Fax: 317-228-1700

Date: November 2019
File # 1344
NOTICE TO BIDDERS

Sealed bid proposals for the Northeastern Wayne School Corporation – Early Childhood Center shall be received by the Owner at the office of the Superintendent of Schools, located at Northeastern High School, 7295 N US Highway 27, Fountain City, IN 47341, until 11:30 a.m. Owner's local time on December 16, 2019. Deliver bids to the main High School office front desk. The bids shall be noted for date and time upon receipt. Bids will be publicly opened immediately after the deadline. Bids received after 11:00 a.m. will be returned unopened. Work shall include, but not be limited to:

1. Site Work:
   a. Minimal, as required for building addition
   b. Lawn restoration.

2. General Construction:
   a. Footings and foundations,
   b. Infill of existing mechanical room,
   c. Unit Masonry,
   d. Metal Studs and Gypsum Board,
   e. Aluminum Windows,
   f. Doors, frames and hardware,
   g. Finishes,

3. Mechanical, Electrical, and Plumbing work:
   a. Removal of existing mechanical system,
   b. Provision of new mechanical system in mezzanine.
   c. Renovation of existing and provision of new toilet rooms,
   d. Electrical Work.

The work shall be awarded as a single Prime Contract. Potential Bidders/Contractors shall be in compliance with all State of Indiana requirements regarding Qualification of Contractors.

Work by the Owner shall include hazardous materials abatement. This work will be completed by separate contract and shall be complete prior to January 1, 2020.

Special Note: The Owner shall begin use of the building for its Early Childhood program beginning in the Fall of 2020. It is imperative that the Work be complete and ready for Owner occupancy and set up no later than July 19, 2020. Minor punch list items may continue until July 31, 2020. Extension of the Work beyond these dates shall not be acceptable for any reason.

A pre-bid conference shall be held on December 6, 2019 at 1:00 P.M. Interested Bidders are encouraged to attend, and shall meet at the office of the Superintendent of Schools, 314 West Main Street, Fountain City, IN 47314

The work shall meet requirements of the contract documents prepared by Stair Associates Inc. These contract documents shall be on file and may be examined at the office of the Superintendent of Schools, 314 West Main Street, Fountain City, IN 47314, the Office of the Engineer (Stair Associates, inc.), Plan Room of Bid Tool, Builders Exchange of Louisville, Kentucky, Construction League of Indianapolis, Construction News Service of Indiana, Construction Software Technology, Indiana Business Diversity Council, Indianapolis, IN, McGraw-Hill / F.W. Dodge Corporation (Ft. Wayne, Indianapolis, and Cincinnati), National Construction News, and Reed Construction Data.

Contract documents may be obtained on or about November 18, 2019 with a refundable deposit of $100.00 by prospective Prime Bidders from the printer, Eastern Engineering, 9901 Allisonville Road, Fishers, IN 46038, Phone: (317) 598-0661; fax: (317) 598-0630: or over the web at
www.easternengineering.com. Deposits shall be in the form of checks or money orders, and be made payable to the Northeastern Wayne School Corporation. A Prime Bidder is defined as any contractor submitting a Bona Fide bid for the work as described. Other subcontractors and material suppliers may purchase plans. Bids will be executed on proposal forms furnished by the Architect/Engineer, which are in accordance with the Indiana State Board of Accounts Form No. 96, (current revision) as required by the Statutes of the State of Indiana.

Each Bona Fide bid shall be accompanied by a certified check, a cashier’s check, or a Bid Bond for 10% of the base bid plus all additive Alternate bids payable to the Northeastern Wayne School Corporation. 110% performance and payment bonds will be required from successful bidder. Bonds shall be made only with approved surety companies and said bonds shall remain in force and effect for a period of twelve (12) months from the date of completion and acceptance of the longest guarantee provided under the Contractor’s contract. No bid shall be withdrawn after the opening of bids for 60 days without consent of the Owner, and the Owner reserves the right to reject any and all bids, or waive any bidding informalities.

Dated November 2019
Board of Trustees
Northeastern Wayne School Corporation
SECTION 00 11 00 –INSTRUCTIONS TO BIDDERS

BID OPENING TIME & LOCATION

1. Sealed bid proposals for the Northeastern Wayne School Corporation – Early Childhood Center, shall be received as described in Specification Section 00 00 10 Notice to Bidders.

2. Bids shall be delivered in a sealed envelope indicating “Sealed Bid Enclosed”, the Bidder’s name and address, and “Northeastern Wayne School Corporation – Early Childhood Center”. Bids shall be submitted on the Bid Proposal Form and Checklist provided in the specifications, or a facsimile thereof. State bid form 96 shall also be completed and included.

3. Local Contractors are encouraged to bid this project as a Prime Contractor or as a Sub-contractor to a prime bidding Contractor. A list of prime bidding Contractors may be obtained from Eastern Engineering Supply, Inc, 9901 Allisonville Road, Fishers, IN, (317)598-0661, www.easternengineering.com.

LOCATION & EXAMINATION OF SITE

4. The Work is located:
   
   314 West Main Street,
   Fountain City, IN
   47314

5. Bidders are required to familiarize themselves of the conditions under which the Work is to be performed, the site of the Work, the obstacles that may be encountered and all other relevant matter concerning the Work to be performed. No subsequent extras shall be allowed due to a claim of lack of knowledge of conditions at site or any matter or thing concerning which the bidder could have informed itself prior to the bidding.

DRAWINGS AND SPECIFICATIONS

6. Copies of the Bidding Documents may be obtained from Eastern Engineering Supply, Inc, 9901 Allisonville Road, Fishers, IN, (317)598-0661, www.easternengineering.com. Costs associated with digital and printed plans and specifications obtained from Eastern Engineering Supply, Inc. are and will be incurred by and at the expense of the contractor and are non-refundable.

7. Amounts shall be written with ink or by typewriter in words and figures. Should there be any discrepancies between the words and figures indicating any amount in the proposal, the amount written in words shall be taken as the correct amount.

8. Any bid not signed by the Individual making same shall have attached to it a Power of Attorney evidencing authority to sign the bid in the name of the person for whom it is signed.

9. A bid signed for a partnership shall be signed by all of the partners, or by an attorney-in-fact. If signed by an attorney-in-fact, there shall be attached to the bid a Power of Attorney, evidencing authority to sign the bid, executed by the partners.
10. Bids which are submitted by a corporation shall have the correct name thereof and the signatures of the president (or other authorized officer of the corporation) and secretary, manually written below the corporate name, following the word “By______________________________", and shall have affixed the corporate seal.

11. Any bidder may withdraw its bid at any time prior to the scheduled time for receipt and opening of bids.

12. No bid shall be withdrawn after the opening of bids without consent of Owner.

TIME OF COMPLETION

13. Contractors shall commence work upon notification, and shall have the building completed, ready for occupancy within the period of time indicated with its bid. See Specification Section Summary of Work.

14. Delays in construction caused by conditions clearly beyond the control of the Contractor shall be the sole reason for extension of the completion date. The Contractor shall consider normal seasonal weather conditions in its proposed construction schedule.

It is imperative that the Work be complete in time to allow occupancy for the Owner’s Fall term. The Contractor shall be responsible for making-up the schedule should any conditions beyond its control arise. The Contractor MAY, at the discretion of the Owner, be due additional compensation should conditions beyond its control occur resulting in unavoidable delays.

SUPPLEMENTS TO THE BID

15. Within 24 hours following the opening of the bids each Bidder shall deliver to Architect-Engineer the required Supplements to the Bid, including but not limited to a list of the subcontractors and suppliers which it proposes to use if awarded the Contract. Changes in supplements to the bid may be made only by agreement between Bidder and Owner prior to the execution of a contract. These supplements, with any such modifications, shall become a part of the contract and shall be binding upon the Contractors as to the subcontractors, materials and equipment used in connection with the Work.

ADDENDA TO CONTRACT DOCUMENTS

16. If any person contemplating submitting a bid for the proposed work is in doubt as to the true meaning of any part of the plans, specifications, or other contract documents, they may submit to the Architect-Engineer a written request for an interpretation thereof. The person submitting the request shall be responsible for its timely delivery such that the response may be included in an addendum. Any explanation or interpretation of the contract documents will be made by addendum duly issued. A copy of such addendum shall be delivered to each Bidder receiving a set of such contract documents, to plan rooms, and to such other prospective bidders as shall have requested in writing that they be furnished with a copy of such addendum. Any explanation or interpretation shall not be considered binding unless published in a duly issued addendum.

17. The Owner shall not be responsible for any other explanation or interpretation of the contract documents. Any such explanation or interpretation shall not be considered binding unless published in a duly issued addendum.
18. An addendum issued by the Owner or the Owner's attorney or the Owner's Architect-Engineer during the time of bidding shall be covered in the proposal and, in closing the contract, shall become a part thereof.

**BONDS**

19. Each bidder shall furnish a “Bid Bond” as described in the Notice to Bidders.

20. The successful bidder shall furnish a "Performance Bond" and "Labor and Material Payment Bond" for 110% of the total contract amount. The performance and payment bond must specify that (1) a modification, omission or addition to the terms and conditions of the contract, plans, specifications, drawings, or profile; (2) a defect in the contract; or (3) a defect in the proceedings preliminary to the letting and awarding of the contract; does not discharge the surety. The surety of performance and payment bond shall not be released until one (1) year after final settlement with the Contractor. The payment bond shall be binding on the Contractor, the subcontractor, and their successors and assigns for the payment of all indebtedness to a person for labor and services rendered. The payment bond must state that it is for the benefit of the subcontractors, laborers, material suppliers and those performing services. Bonds shall be made only with approved surety companies and said bonds shall remain in force and effect for a period of twelve (12) months from the date of completion and acceptance of the longest guarantee provided under the Contractor’s contract.

**RETAINEAGE.**

21. Until the work reaches fifty percent (50%) completion, including both materials and labor, the Owner shall pay the Contractor ninety percent (90%) of the total earned as calculated on AIA Document G702, with the balance being held as Retainage until project completion.

22. The Contractor may petition the Owner to cease holding Retainage on additional payments beyond the initial fifty percent (50%) of the Work after this percentage of the work is complete. The Retainage on the original fifty percent (50%) of the work shall be held until project completion. The Owner shall not hold additional retainage if the completed Work is of an acceptable quality, and in conformance with the schedule provided in Specification Section 01 01 00 – Summary, and additionally as provided in the Contractor’s critical path schedule.

23. Should the Work not be in conformance with schedule, or in the sole judgment of the Owner, not of an acceptable quality, the Owner shall pay the Contractor ninety percent (90%) of the total earned as calculated on AIA Document G702, with the balance being held as Retainage until the Owner is satisfied with the Contractor’s performance. Payment retained subsequent to 50% completion of the Work shall be held until project completion.

**REJECTION OF BIDS, INFORMALITIES.**

24. The Owner reserves the right to reject any and/or all bids and to waive any informality in bidding.

**END OF SECTION 00 11 00**
Indiana State Board of Accounts State Form 52414 Form #96 is included as follows:
PART I
(To be completed for all bids. Please type or print)

Date (month, day, year): ________________________________

1. Governmental Unit (Owner): ____________________________________________

2. County: ______________________________________________________________

3. Bidder (Firm): __________________________________________________________
   Address: ________________________________________________________________
   City/State/ZIP code: ____________________________________________________

4. Telephone Number: _____________________________________________________

5. Agent of Bidder (if applicable): __________________________________________

Pursuant to notices given, the undersigned offers to furnish labor and/or material necessary to complete
the public works project of ____________________________________________
(Governmental Unit) in accordance with plans and specifications prepared by ______________________
______________________________________________________________ and dated ____________________ for the sum of
$ ________________________________

The undersigned further agrees to furnish a bond or certified check with this bid for an amount specified in the
notice of the letting. If alternative bids apply, the undersigned submits a proposal for each in accordance with the
notice. Any addendums attached will be specifically referenced at the applicable page.

If additional units of material included in the contract are needed, the cost of units must be the same as
that shown in the original contract if accepted by the governmental unit. If the bid is to be awarded on a unit
basis, the itemization of the units shall be shown on a separate attachment.

The contractor and his subcontractors, if any, shall not discriminate against or intimidate any employee,
or applicant for employment, to be employed in the performance of this contract, with respect to any matter
directly or indirectly related to employment because of race, religion, color, sex, national origin or ancestry.
Breach of this covenant may be regarded as a material breach of the contract.

CERTIFICATION OF USE OF UNITED STATES STEEL PRODUCTS
(if applicable)

I, the undersigned bidder or agent as a contractor on a public works project, understand my statutory
obligation to use steel products made in the United States (I.C. 5-18-8-2). I hereby certify that I and all
subcontractors employed by me for this project will use U.S. steel products on this project if awarded. I
understand that violations hereunder may result in forfeiture of contractual payments.
ACCEPTANCE

The above bid is accepted this ____________ day of ________________, __________, subject to the following conditions: ______________________________________________________

Contracting Authority Members:

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

PART II

(For projects of $150,000 or more – IC 36-1-12-4)

Governmental Unit: ______________________________________________________

Bidder (Firm) __________________________________________________________

Date (month, day, year): ________________________________________________

These statements to be submitted under oath by each bidder with and as a part of his bid. Attach additional pages for each section as needed.

SECTION I EXPERIENCE QUESTIONNAIRE

1. What public works projects has your organization completed for the period of one (1) year prior to the date of the current bid?

<table>
<thead>
<tr>
<th>Contract Amount</th>
<th>Class of Work</th>
<th>Completion Date</th>
<th>Name and Address of Owner</th>
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</table>

2. What public works projects are now in process of construction by your organization?

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<thead>
<tr>
<th>Contract Amount</th>
<th>Class of Work</th>
<th>Expected Completion Date</th>
<th>Name and Address of Owner</th>
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</table>

3. Have you ever failed to complete any work awarded to you? ________________ If so, where and why?
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

4. List references from private firms for which you have performed work.
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

SECTION II PLAN AND EQUIPMENT QUESTIONNAIRE

1. Explain your plan or layout for performing proposed work. *(Examples could include a narrative of when you could begin work, complete the project, number of workers, etc. and any other information which you believe would enable the governmental unit to consider your bid.)*
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

2. Please list the names and addresses of all subcontractors *(i.e. persons or firms outside your own firm who have performed part of the work)* that you have used on public works projects during the past five (5) years along with a brief description of the work done by each subcontractor.
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
3. If you intend to sublet any portion of the work, state the name and address of each subcontractor, equipment to be used by the subcontractor, and whether you will require a bond. However, if you are unable to currently provide a listing, please understand a listing must be provided prior to contract approval. Until the completion of the proposed project, you are under a continuing obligation to immediately notify the governmental unit in the event that you subsequently determine that you will use a subcontractor on the proposed project.

4. What equipment do you have available to use for the proposed project? Any equipment to be used by subcontractors may also be required to be listed by the governmental unit.

5. Have you entered into contracts or received offers for all materials which substantiate the prices used in preparing your proposal? If not, please explain the rationale used which would corroborate the prices listed.

SECTION III CONTRACTOR'S FINANCIAL STATEMENT

Attachment of bidder’s financial statement is mandatory. Any bid submitted without said financial statement as required by statute shall thereby be rendered invalid. The financial statement provided hereunder to the governing body awarding the contract must be specific enough in detail so that said governing body can make a proper determination of the bidder’s capability for completing the project if awarded.
SECTION IV CONTRACTOR'S NON-COLLUSION AFFIDAVIT

The undersigned bidder or agent, being duly sworn on oath, says that he has not, nor has any other member, representative, or agent of the firm, company, corporation or partnership represented by him, entered into any combination, collusion or agreement with any person relative to the price to be bid by anyone at such letting nor to prevent any person from bidding nor to include anyone to refrain from bidding, and that this bid is made without reference to any other bid and without any agreement, understanding or combination with any other person in reference to such bidding.

He further says that no person or persons, firms, or corporation has, have or will receive directly or indirectly, any rebate, fee, gift, commission or thing of value on account of such sale.

SECTION V OATH AND AFFIRMATION

I HEREBY AFFIRM UNDER THE PENALTIES FOR PERJURY THAT THE FACTS AND INFORMATION CONTAINED IN THE FOREGOING BID FOR PUBLIC WORKS ARE TRUE AND CORRECT.

Dated at ___________________________ this ______________ day of ________________________, __________

__________________________________________
(Name of Organization)

By ________________________________

__________________________________________
(Title of Person Signing)

ACKNOWLEDGEMENT

STATE OF ____________________________
COUNTY OF ____________________________

Before me, a Notary Public, personally appeared the above-named ___________________________ and

swore that the statements contained in the foregoing document are true and correct.

Subscribed and sworn to before me this ______________ day of ________________________, __________.

__________________________________________
Notary Public

My Commission Expires: ___________________________

County of Residence: ___________________________
BID OF

(Contractor)

(Address)

FOR

PUBLIC WORKS PROJECTS

OF

Filed ____________________________

Action taken ____________________________
To: Northeastern Wayne School Corporation  
Project: Early Childhood Center  

1. **OFFER**  
Pursuant to and in compliance with Document 00 10 00 - Instructions to Bidders and all other Bidding Documents prepared by Stair Associates Inc., the undersigned, having become thoroughly familiar with the terms and conditions of the proposed Work and having fully inspected the existing facility, hereby proposes to fully perform the Work within the time stated and in strict accordance with the Contract Documents. This Bid Proposal includes all costs for the provision of insurance, labor, materials, equipment, allowances, and all other requirements as described in the Contract Documents. This bid proposal further includes the Work required to complete all Owner accepted alternates in the amount(s) indicated following:

**Base Bid:** All Work described in the contract documents EXCEPT that described as an alternate:

<table>
<thead>
<tr>
<th>Amount</th>
<th>Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>(In words)</td>
<td></td>
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<tr>
<td>($__________________________)</td>
<td>(In Numerals)</td>
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</table>

**Alternate Bid #1: Windows:**

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<th>Amount</th>
<th>Dollars</th>
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<tr>
<td>($__________________________)</td>
<td>(In Numerals)</td>
</tr>
</tbody>
</table>

**Alternate Bid #2: Re-roof Existing Building:**

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<th>Amount</th>
<th>Dollars</th>
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<tbody>
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<td>(In words)</td>
<td></td>
</tr>
<tr>
<td>($__________________________)</td>
<td>(In Numerals)</td>
</tr>
</tbody>
</table>
Alternate Bid #3: Solid Surface:

Amount ___________________________________ Dollars
(In words)

($ ___________________________ )
(In Numerals)

Alternate Bid #4: Paint Existing EIFS:

Amount ___________________________________ Dollars
(In words)

($ ___________________________ )
(In Numerals)

Unit Price: Tuck Pointing:

Amount ___________________________________ Dollars per Sq. Ft.
(In words)

($ ___________________________ ) per Sq. Ft.
(In Numerals)

2. ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for sixty (60) days from the Bid opening date.

If the Owner accepts this Bid within the time period stated, we will:

▪ Execute the Agreement within ten days of receipt of Notice of Award.
▪ Furnish the required bonds and insurance certification within ten days of receipt of Notice of Award in the form described in Supplementary Conditions.
▪ Commence work as noted in the Summary.

3. CONTRACT TIME

The undersigned Bidder agrees to coordinate and expedite his work in strict accordance with the schedule indicated in Specification Section 01 01 00 Summary which will provide the time required to complete his Work in accordance with this offer.

NOTE: See Specification Section 01 01 00 for Special Note relative to the schedule.

4. ADDENDA
The following Addenda have been received. The modifications to the Bidding documents noted therein have been considered and all costs thereto are included in the Bid Sum.

<table>
<thead>
<tr>
<th>Addendum #</th>
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</table>

5. **BID REQUIREMENTS CHECKLIST**

<table>
<thead>
<tr>
<th>Bid Requirements</th>
<th>Checklist</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Form 96</td>
<td>Submitted in Duplicate</td>
</tr>
<tr>
<td>Bid Bond or Check</td>
<td>Addenda Acknowledged</td>
</tr>
<tr>
<td>Financial Statement</td>
<td>All Signatures that are required</td>
</tr>
</tbody>
</table>

6. **NON-DISCRIMINATION**

The Undersigned and its subcontractors or any person on their behalf, if any, shall not discriminate against or intimidate any employee or applicant for employment, to be employed in the performance of this Contract, with respect to his/her hire, tenure, terms, conditions or privileges of employment or any matter directly or indirectly related to employment because of his/her sex, race, color, religion, national origin, handicap or ancestry. Breach of this covenant may be regarded as a material breach of the Contract.

7. **BIDDER REQUIREMENTS**

Provide documentation of five (5) projects of similar scope and complexity satisfactorily completed in the last three (3) years. **Contact person means person employed by project Owner.**

1. Project: _____________________________________________
   
   Completed: ______ Contact Person: _______________ Phone # (____) ________

2. Project: _____________________________________________
   
   Completed: ______ Contact Person: _______________ Phone # (____) ________

3. Project: _____________________________________________
   
   Completed: ______ Contact Person: _______________ Phone # (____) ________

4. Project: _____________________________________________
   
   Completed: ______ Contact Person: _______________ Phone # (____) ________

5. Project: _____________________________________________
   
   Completed: ______ Contact Person: _______________ Phone # (____) ________
8. **FINANCIAL STATEMENT**

Include with this Bid Proposal a Financial Statement as required by Indiana State Board of Accounts, State Form 52414 Form #96.

9. **SUPPLEMENTAL FORMS**

In submitting this proposal, the undersigned agrees to provide Specifications Section 00 40 00: Subcontractors, Suppliers and Manufacturers, which must be submitted within 24 hours following the opening of the bids.

10. **CONTRACTOR QUALIFICATION**

   (Initial)

   In submitting this proposal, the undersigned states that the Bidder is in compliance with Specification Section 00 83 01 – Contractor Qualification.

11. **EMPLOYEE SCREENING**

   (Initial)

   In submitting this proposal, the undersigned agrees to provide Employee Screening as described in Specification Section 008310 – Employee Screening.

12. **IRAN INVESTMENT ACTIVITIES**

   (Initial)

   In submitting this proposal, the undersigned states that the Bidder is in compliance with Specification Section 00 83 11 Iran Investment Activities.

13. **BID FORM SIGNATURE(S)**

   Initial items 10, 11, and 12 above.

   Name of Proprietorship, Partnership, or Corporation: ________________________________

   Authorized signing officer name (printed): ________________________________

   Authorized signing officer title (printed): ________________________________

   Authorized officer signature: ________________________________

   Bidder contact telephone: ________________________________

   Bidder contact e-mail address: ________________________________

   If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

   ________________________________ Witness ________________________________

   ________________________________ Witness ________________________________
SECTION 00 40 00 – SUPPLEMENT TO THE BID: SUBCONTRACTORS, SUPPLIERS, AND MANUFACTURERS

The following information must be submitted within 24 hours following the opening of the bids.

Date: ____________________

Submitted by:

___________________________________________
(Proprietorship, Partnership, or Corporation)

___________________________________________
(Full name printed)

___________________________________________
(Signature)

In signing above the Bidder warrants that all Subcontractors, Suppliers, or Manufacturers with which the Prime Contractor enters into a contract for $300,000 or greater shall be in compliance with Specification Section 00 83 01 whether or not included on the following list.

Subcontractors, Suppliers and Manufacturers List

The following work will be performed (or provided) by the Subcontractors and Manufacturers listed herein, and coordinated by us:

<table>
<thead>
<tr>
<th>SECTION OF WORK</th>
<th>SUBCONTRACTOR/SUPPLIER</th>
<th>MANUFACTURER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Masonry</td>
<td></td>
<td></td>
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<tr>
<td>Casework</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminum Windows and Storefront</td>
<td></td>
<td></td>
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<tr>
<td>Gypsum Board and Framing</td>
<td></td>
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<tr>
<td>Doors and Hardware</td>
<td></td>
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</tr>
</tbody>
</table>

Division 21:

| N/A                                    |                        |              |

Division 22:

<p>| Plumbing components                    |                        |              |</p>
<table>
<thead>
<tr>
<th>Division 23:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Components</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Division 26:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wires and Cables</td>
<td></td>
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<tr>
<td>Occupancy Sensors</td>
<td></td>
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<tr>
<td>Lighting Fixtures</td>
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</table>

<table>
<thead>
<tr>
<th>Division 27:</th>
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<tbody>
<tr>
<td>Horizontal Cabling</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Division 28:</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>Fire Alarm System</td>
<td></td>
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</tbody>
</table>

END OF SECTION 00 40 00
SECTION 00 43 12 – FINANCIAL STATEMENT

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes the State Board of Accounts Form #102, Standard Questionnaires and Financial Statement for Bidders. Form #102 follows this page.

1. Contractor’s Bid for Public Work (Form 96) requires a financial statement “specific enough in detail so that said governing body can make a proper determination of the bidders’ capability for completing the project if awarded.”

2. Each Bidder may, at its option:
   a. Complete Form #102 – Standard Questionnaires and Financial Statement for Bidders as included in the project manual in its entirety.
   b. Provide an audited financial statement current to within 180 days of the date for receipt of Bids. Should an audited financial statement be utilized, the Bidder must also complete the following pages from Form #102:
      2. Structure and Signature – Pages 13 and 14.

1.02 Related Sections

A. Related Sections include the following:

1. Division 00 Section “Bid Form”.

END OF SECTION 00 43 12
Standard Questionnaires and Financial Statement for Bidders

For use in investigating the qualifications of bidders on public works contracts when the aggregate cost of such contract will be a hundred thousand dollars ($100,000) or more. This form may be used for any other contract when the ordering department requests it.

These statements are to be submitted under oath by each bidder with and as a part of the bid.

NOTE: THIS FORM BECOMES PART OF THE BID FILE, AND PURSUANT TO INDIANA’S PUBLIC RECORDS LAW (IND. CODE SS5-14-3-1-5-14-3-10), WILL BE AVAILABLE FOR PUBLIC INSPECTION AND COPYING DURING CENTRAL PURCHASING’S REGULAR BUSINESS HOURS WHEN THE TOTAL CONTRACT PRICE EXCEEDS $100,000.

Submitted to:
Company Name: ____________________________________________________________
Address: __________________________________________________________________
________________________________________________________________________
Representative: ____________________________________________________________
Telephone Number: _________________________________________________________
Date Submitted: _____________________________________________________________

TO THE BIDDER:

These forms have been prescribed by the State Board of Accounts.

The purpose of the questionnaire is to enable the awarding body to determine the qualifications of the bidder to carry out successfully the contract if the same is awarded to the bidder.

The bidder will find it to his advantage to answer fully all questions coming within the range of the work being bid. Particular attention should be given to the “Financial Statement” and the details relative to the assets and liabilities set out. This form is made in extensive detail so that the bidder may explain his assets and liabilities in proper sequence and in a uniform manner. NOTE; FAILURE TO FILL OUT THESE FORMS COMPLETELY MAY BE GROUNDS FOR DECLARING THE ENTIRE BID NON-RESPONSIVE.
EXPERIENCE QUESTIONNAIRE

The signatory of this questionnaire guarantees the truth and accuracy of all statements and of all answers to interrogatories hereinafter made.

1. How many years has your organization been in business as a general contractor under your present business name? 

2. How many years’ experience in __________________________ construction work has your organization had:
   (a) As a general contractor __________________________ (b) as a sub-contractor __________________________

3. What projects has your organization completed?

<table>
<thead>
<tr>
<th>CONTRACT AMOUNT</th>
<th>CLASS OF WORK</th>
<th>WHEN COMPLETED</th>
<th>NAME AND ADDRESS OF OWNER</th>
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</table>

3A What projects has your organization now in process of construction?

<table>
<thead>
<tr>
<th>CONTRACT AMOUNT</th>
<th>CLASS OF WORK</th>
<th>WHEN TO BE COMPLETED</th>
<th>NAME AND ADDRESS OF OWNER</th>
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</table>

4. Have you ever failed to complete any work awarded to you? ________________ If so, where and why?

5. Has any offer or partner of your organization ever been an officer or partner of some other organization that failed to complete a construction contract? ________________ If so, state name of individual, other organization and reason therefor.

6. Has any officer or partner of your organization ever failed to complete a construction contract handled in his own name? _____ If so, state name of individual, name of owner and therefor. ________________
7. In what other lines of business are you financially interested? _____________________________________________
   _____________________________________________
   _____________________________________________

8. For what corporation or individuals have you performed work, and to whom do you refer? _________________________
   _____________________________________________
   _____________________________________________
   _____________________________________________

9. For what cities have you performed work and to whom do you refer? _________________________
   _____________________________________________
   _____________________________________________
   _____________________________________________

10. For what countries have you performed work and to whom do you refer? _________________________
    _____________________________________________
    _____________________________________________
    _____________________________________________

11. For what State bureaus or departments have you performed work and to whom do you refer? _________________________
    _____________________________________________
    _____________________________________________
    _____________________________________________

12. Have you ever performed any work for the U.S. Government? _________________________
    If so, when and to whom do you refer? _____________________________________________
    _____________________________________________
    _____________________________________________

13. What is the construction experience of the principal individual of your organization?

<table>
<thead>
<tr>
<th>INDIVIDUAL’S NAME</th>
<th>PRESENT POSITION OR OFFICE</th>
<th>YEARS OF CONSTRUCTION EXPERIENCE</th>
<th>MAGNITUDE AND TYPE OF WORK</th>
<th>IN WHAT CAPACITY</th>
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</table>

-3-
PLAN AND EQUIPMENT QUESTIONNAIRE

The signatory of this questionnaire guarantees the truth and accuracy of all statements and of all answers to interrogatories hereinafter made.

1. In what manner have you inspected this proposed work? Explain in detail.

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

2. Explain your plan or layout for performing the proposed work _______________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

3. The work, if awarded to you, will have the personal supervision of whom? ______________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

*4. Do you intend to do the hauling on the proposed work with your own forces? ____________
    If so, give amount and type of equipment used ________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

*5. If you intend to sublet the hauling or perform it through an agent, state amount of sub-contract or agent’s contract, and if known, the name and address of sub-contractor or agent, amount and type of his equipment and financial responsibility ____________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

* Items 4, 5, 6, and 7 may not be applicable in all building contracts; if not, omit.
* 6. Do you intend to do the grading on the proposed work with your own forces? ________________________________
   If so, give type of equipment to be used ________________________________

* 7. If you intend to sublet the grading or perform it through an agent, state amount of subcontract or agent’s contract, and if known, the name and address of sub-contractor or agent, amount and type of his equipment and financial responsibility. ________________________________

8. Do you intend to sublet any other portions of the work? ________________________________
   If so, state amount of sub-contract, and if known, the name and address of the sub-contractor, whether subcontract is a minority and/or women’s business enterprise, amount, and type of his equipment and financial responsibility. ________________________________

9. From which sub-contractors or agents do you expect to require a bond? ________________________________

10. What equipment do you own that is available for the proposed work?

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>ITEM</th>
<th>DESCRIPTION, SIZE, CAPACITY, ETC.</th>
<th>CONDITION</th>
<th>YEARS OF SERVICE</th>
<th>PRESENT LOCATION</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>
11. What equipment do you intend to purchase for use on the proposed work, should the contract be awarded to you?

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>ITEM</th>
<th>DESCRIPTION, SIZE, CAPACITY, ETC.</th>
<th>APPROXIMATE COST</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

12. How and when will you pay for the equipment to be purchased?

13. Do you propose to rent any equipment for this work? ________________ if so, state type, quantity and reasons for renting.

14. Have you made contracts or received firm offers for all materials within prices used in preparing your proposal? Do not give names of dealers or manufacturers ________________

15. List all permits, licenses, or registrations, which you have and are required by law to maintain in order to bid on this work. Please include the type of the permit, license, or registration; the name of the issuing entity; the number of the licenses, permit, or registration; and the expiration date.

Dated at ________________ this ________________ day of ________________, 20__

______________ (Name of Organization)

By ________________

STATE OF ________________________________

COUNTY OF ________________________________, SS:

Being duly sworn, deposes and says that he is

______________ (Name of Organization)

and that the answers to the questions in the foregoing questionnaires and all statements therein contained are true and correct.

Subscribed and sworn to before me this ________________ day of ________________, 20__.

My Commission expires ________________________________

______________ Notary Public
# CONTRACTOR’S FINANCIAL STATEMENT

Submitted by __________________________________________________________

Principal Office at ___________________________________________________

To _________________________________________________________________

<table>
<thead>
<tr>
<th>Condition at close of business</th>
<th>20</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>ASSETS</th>
<th>Dollars</th>
<th>Cts.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cash: (a) On Hand $<em><strong><strong><strong><strong>, (b) In bank $</strong></strong></strong></strong></em>___, (c) Elsewhere $</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Notes receivable (a) Due within 90 days ________________________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) Due after 90 days _________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(c) Past Due _________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Accounts receivable from completed contracts, exclusive of claims not approved for payment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Sums earned on uncompleted contracts as shown by engineer’s or architect’s estimate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Amount receivable after deducting retainage __________________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) Retainage to date, due upon completion of contracts ____________________</td>
<td></td>
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</tr>
<tr>
<td>5. Accounts receivable from sources other than construction contracts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Deposits for bids or other guarantees: (a) Recoverable within 90 days</td>
<td></td>
<td></td>
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<tr>
<td>(b) Recoverable after 90 days</td>
<td></td>
<td></td>
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<tr>
<td>7. Interest accrued on loans, securities, etc. _____________________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Real Estate: (a) Used for business purposes ____________________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) Not used for business purposes ______________________________________</td>
<td></td>
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<tr>
<td>9. Stocks and bonds: (a) Listed - - present market value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) Unlisted - - present value</td>
<td></td>
<td></td>
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<tr>
<td>10. Materials in stock included in Item 4 (a) For uncompleted contracts (present value)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) Other materials (present value)</td>
<td></td>
<td></td>
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<tr>
<td>11. Equipment, book value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Furniture and fixtures, book value</td>
<td></td>
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<tr>
<td>13. Other Assets</td>
<td></td>
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</tr>
</tbody>
</table>

Total assets ____________________________
| 1. Notes payable | (a) To banks regular |  |  |
| | (b) To banks for certified checks |  |  |
| | (c) To others for equipment obligations |  |  |
| | (d) To others exclusive of equipment obligations |  |  |
| 2. Accounts payable | (a) Not past due |  |  |
| | (b) Past due |  |  |
| 3. Real estate encumbrances |  |  |  |
| 4. Other liabilities |  |  |  |
| 5. Reserves |  |  |  |
| 6. Capital stock paid up: | (a) Common |  |  |
| | (b) Common |  |  |
| | (c) Preferred |  |  |
| | (d) Preferred |  |  |
| 7. Surplus (net worth) |  |  |  |

**Total liabilities**

**CONTINGENT LIABILITIES**

| 1. Liability on notes receivable, discounted or sold |  |  |
| 2. Liability on accounts receivable, pledged, assigned or sold |  |  |
| 3. Liability as bondsman |  |  |
| 4. Liability as guarantor on contracts or on accounts of others |  |  |
| 5. Other contingent liabilities |  |  |

**Total contingent liabilities**
## DETAILS RELATIVE TO ASSETS

<p>| | | | | |</p>
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<tbody>
<tr>
<td>1</td>
<td>Cash</td>
<td>(a) on hand</td>
<td>$</td>
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<td></td>
<td></td>
<td>(b) deposited in banks named below</td>
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<td>(c) elsewhere - - (State where)</td>
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<table>
<thead>
<tr>
<th>NAME OF BANK</th>
<th>LOCATION</th>
<th>DEPOSIT IN NAME OF</th>
<th>AMOUNT</th>
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| 2* | Notes Receivable | (a) due within 90 days | $ |   |
|    |                  | (b) due after 90 days |   |   |
|    |                  | (c) past due |   |   |

<table>
<thead>
<tr>
<th>RECEIVABLE FROM: NAME AND ADDRESS</th>
<th>FOR WHAT</th>
<th>DATE OF MATURITY</th>
<th>HOW SECURED</th>
<th>AMOUNT</th>
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Have any of the above been discounted or sold? ________ If so, state amount, to whom, and reason ________

<p>| 3* | Accounts receivable from completed contracts exclusive of claims not approved for payment | $ |</p>
<table>
<thead>
<tr>
<th></th>
<th>NAME AND ADDRESS OF OWNER</th>
<th>NATURE OF CONTRACT</th>
<th>AMOUNT OF CONTRACT</th>
<th>AMOUNT RECEIVABLE</th>
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<tbody>
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Have any of the above been assigned, sold, or pledged? ________ If so, state amount, to whom and reason ________

| 4* | Sums earned on uncompleted contracts, as shown by engineer’s or architect’s estimate: |
|    | (a) Amount receivable after deducting retainage | $ |   |
|    | (b) Retainage to date due upon completion of contract |   |   |
|    | DESIGNATION OF CONTRACT AND NAME AND ADDRESS OF OWNER | AMOUNT OF CONTRACT | AMOUNT EARNED | AMOUNT RECEIVED | RETAINAGE WHEN DUE | AMOUNT | AMOUNT EXCLUSIVE OF RETAINAGE |
|    |                                                   |                   |               |               |                   |        |                           |
|    |                                                   |                   |               |               |                   |        |                           |
|    |                                                   |                   |               |               |                   |        |                           |
|    |                                                   |                   |               |               |                   |        |                           |

Have any of the above been sold, assigned, or pledged? _____ If so, state amount, to whom, and reason ________

*List separately each item amounting to 10 percent or more of the total and combine the remainder.
### DETAILS RELATIVE TO ASSETS (continued)

<table>
<thead>
<tr>
<th>5*</th>
<th>Accounts receivable not from construction contracts</th>
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<tbody>
<tr>
<td></td>
<td>RECEIVABLE: NAME AND ADDRESS</td>
<td>FOR WHAT</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>What amount, if any, is past due</td>
<td>$</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6</th>
<th>Deposits with bids or otherwise as guarantees</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DEPOSITED WITH: NAME AND ADDRESS</td>
<td>FOR WHAT</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7</th>
<th>Interest accrued on loans, securities, etc.</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ON WHAT ACCRUED</td>
<td>TO BE PAID WHEN</td>
</tr>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>8*</th>
<th>Real estate</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a) Used for business purposes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Book value</td>
<td>(b) Not used for business purposes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESCRIPTION OF PROPERTY</th>
<th>IMPROVEMENTS</th>
<th>TOTAL BOOK VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NATURE OF IMPROVEMENTS</td>
<td>BOOK VALUE</td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
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<tr>
<td>3.</td>
<td></td>
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<tr>
<td>4.</td>
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<tr>
<td>5.</td>
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<tr>
<td>6.</td>
<td></td>
<td></td>
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<tr>
<td>7.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>HELD IN WHOSE NAME</th>
<th>ASSESSED VALUE</th>
<th>AMOUNT OF ENCUMBERANCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
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<tr>
<td>3.</td>
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<tr>
<td>4.</td>
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<td>5.</td>
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<td>6.</td>
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<tr>
<td>7.</td>
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</tr>
</tbody>
</table>

* List separately each item amounting to 10 percent or more of the total and combine the remainder.
### Stocks and bonds

(a) Listed - present market value

(b) Unlisted - present value

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>ISSUING COMPANY</th>
<th>LAST INT. OR DIV PAID DATE</th>
<th>PAR VALUE</th>
<th>PRESENT MARKET VALUE</th>
<th>QUANTITY</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>2.</td>
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<td>3.</td>
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<td>4.</td>
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<td>5.</td>
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<td>6.</td>
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<td>7.</td>
<td></td>
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</tr>
</tbody>
</table>

WHO HAS POSSESSION

IF ANY ARE PLEDGED OR IN ESCROW, STATE FOR WHOM AND REASON

<table>
<thead>
<tr>
<th>AMOUNT PLEDGED OR IN ESCROW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
<tr>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
</tr>
<tr>
<td>6.</td>
</tr>
<tr>
<td>7.</td>
</tr>
</tbody>
</table>

### Materials in stock and not included in Item 4, Assets:

(a) For use on uncompleted contracts (present value)

(b) Other materials (present value)

<table>
<thead>
<tr>
<th>DESCRIPTION OF MATERIAL</th>
<th>QUANTITY</th>
<th>PRESENT VALUE FOR UNCOMPLETED CONTRACTS</th>
<th>OTHER MATERIALS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

### Equipment at book value

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>DESCRIPTION AND CAPACITY OF ITEMS</th>
<th>AGE OF ITEMS</th>
<th>PURCHASE PRICE</th>
<th>DEPRECIATION CHARGED OFF</th>
<th>BOOK VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Are there any liens against the above? If so, state total amount

* If two or more items are lumped above, give the sum of their ages.
### DETAILS RELATIVE TO ASSETS (continued)

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furniture and fixtures at book value</td>
<td></td>
</tr>
<tr>
<td>Other Assets</td>
<td></td>
</tr>
</tbody>
</table>

### TOTAL ASSETS

| $ |

### DETAILS RELATIVE TO LIABILITIES

<table>
<thead>
<tr>
<th>Notes payable</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) To banks, regular</td>
<td></td>
</tr>
<tr>
<td>(b) To banks for certified checks</td>
<td></td>
</tr>
<tr>
<td>(c) To others for equipment obligations</td>
<td></td>
</tr>
<tr>
<td>(d) To others exclusive of equipment obligations</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>To Whom: Name and Address</th>
<th>What Security</th>
<th>When Due</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accounts payable</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Not past due</td>
<td></td>
</tr>
<tr>
<td>(b) Past Due</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>To Whom: Name and Address</th>
<th>For What</th>
<th>Date Payable</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

| Real estate encumbrances (see Item 8, Assets) | $ |
| Other liabilities                                    | $ |

### RESERVES

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest</td>
<td></td>
</tr>
<tr>
<td>Insurance</td>
<td></td>
</tr>
<tr>
<td>Bldgs. &amp; Fixt.</td>
<td></td>
</tr>
<tr>
<td>Plant Depr.</td>
<td></td>
</tr>
<tr>
<td>Taxes</td>
<td></td>
</tr>
<tr>
<td>Bad Debts</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interests</th>
<th>Insurance</th>
<th>Bldgs. &amp; Fixt.</th>
<th>Plant Depr.</th>
<th>Taxes</th>
<th>Bad Debts</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capital stock paid up</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Common</td>
<td></td>
</tr>
<tr>
<td>(b) Preferred</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surplus</th>
<th>$</th>
</tr>
</thead>
</table>

### TOTAL LIABILITIES

| $ |

-12-
If a corporation answer this:
Amount for which incorporated $__________________________
Capital paid in cash $__________________________
When incorporated ____________________________
In what state ____________________________
Names and titles of all persons having authority to execute and receipt estimate vouchers and to conduct other business for the corporation, including its officers, the signatures of whom are legally binding.

Do you have necessary “certificate of existence” (or certificate of authorization for a foreign corporation) to transact corporate business in this state, under the terms of Public Law 149, Acts of 1986, and acts amendatory thereto? ____________________________

If a co-partnership answer this:
Date of organization ____________________________
State whether co-partnership is general, limited or association ____________________________
Give the names, addresses and proportional interests of all parties:

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$</td>
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<td>$</td>
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<td></td>
<td></td>
<td>$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$</td>
</tr>
</tbody>
</table>

The name of the partnership firm under which the above partners are operating is ____________________________

Give names and titles of all having authority to execute and receipt estimate vouchers and to conduct other business for the partnership, the signatures of whom are legally binding.

-13-
The undersigned hereby declares that the foregoing is a true statement of the financial condition of the individual, co-partnership, or corporation herein first named, as of the date herein first given; that this statement is for the express purpose of inducing the party to whom it is submitted to award the submitter a contract; and that any depository, vendor or other agency herein named is hereby authorized to supply such party with any information necessary to verify this statement.

NOTE: A co-partnership must give firm name and signatures of all partners. A corporation must give full corporate name, signature of official and affix corporate seal.

---

Affidavit for Individual

STATE OF
COUNTY OF

being duly sworn, deposes and says that the foregoing financial statement, taken from his books, is a true and accurate statement of his financial condition as of the date thereof and that the answers to the foregoing interrogatories are true.

Subscribed and sworn to before me this

 day of 20

Notary Public

---

Affidavit for Co-Partnership

STATE OF
COUNTY OF

being duly sworn, deposes and says that he is a member of the firm of: that he is familiar with the books of the said firm showing its financial condition; that the foregoing financial statement, taken from the books of said firm, is a true and accurate statement of the financial condition of the said firm as of the date thereof and that the answer to the foregoing interrogatories are true.

Subscribed and sworn to before me this

 day of 20

Notary Public

---

Affidavit for Corporation

STATE OF
COUNTY OF

being duly sworn, deposes and says that he is of the , corporation described in and which executed the foregoing statement; that he is familiar with the books of the said corporation showing its financial condition; that the foregoing financial statement, taken from the books of the said corporation, is a true and accurate statement of the financial condition of said corporation as of the date thereof and that the answers to the foregoing interrogatories are true.

Subscribed and sworn to before me this

 day of 20

Notary Public

---
SECTION 00 70 00 – GENERAL CONDITIONS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Form of the Document: AIA Document A201 of the “General Conditions of the Contract for Construction”, a copy of which is enclosed herein.

B. Intent of the Document: A201, shall be adopted as one of the Contract Documents forming the Construction Contract, shall establish a basis for defining relationships; and shall allocate the proper legal responsibilities of the parties, along with Supplementary General Conditions, Addenda, and other requirements as defined in Contract Documents.
General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

Stair Associates, Inc.
9641 Commerce Dr.
Carmel, IN 46032
317-228-1900

TABLE OF ARTICLES

1. GENERAL PROVISIONS
2. OWNER
3. CONTRACTOR
4. ARCHITECT
5. SUBCONTRACTORS
6. CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
7. CHANGES IN THE WORK
8. TIME
9. PAYMENTS AND COMPLETION
10. PROTECTION OF PERSONS AND PROPERTY
11. INSURANCE AND BONDS
12. UNCOVERING AND CORRECTION OF WORK
13. MISCELLANEOUS PROVISIONS

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

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

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.
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15 CLAIMS AND DISPUTES
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ARTICLE 1  GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor’s bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect’s consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect’s consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect’s duties.

§ 1.1.3 The Work

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

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.
§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties’ intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization
Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation
In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

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

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect’s consultants.

§ 1.6 Notice
§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

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

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

ARTICLE 2 OWNER
§ 2.1 General
§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner’s approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term “Owner” means the Owner or the Owner’s authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic’s lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner’s interest therein.

§ 2.2 Evidence of the Owner’s Financial Arrangements
§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner’s obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner’s obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner’s ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor’s request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor’s reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days’ notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner
§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.
§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner’s control and relevant to the Contractor’s performance of the Work with reasonable promptness after receiving the Contractor’s written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner’s Right to Stop the Work
If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner’s Right to Carry Out the Work
If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.7.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner’s expenses and compensation for the Architect’s additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR
§ 3.1 General
§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor’s authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect’s administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor
§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.
§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor’s review is made in the Contractor’s capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor’s notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures
§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor’s best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor’s proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

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

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials
§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.
§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor’s employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty
§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor’s warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes
The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

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

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions
If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor’s cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect’s determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.
§ 3.8 Allowances
§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,
   1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
   2 Contractor’s costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
   3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor’s costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent
§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner’s consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor’s Construction and Submittal Schedules
§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner’s and Architect’s information a Contractor’s construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect’s approval. The Architect’s approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor’s construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

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

§ 3.11 Documents and Samples at the Site
The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and
delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples
§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect’s approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect’s approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect’s approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor’s responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely
upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional’s written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor’s design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

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

§ 3.14 Cutting and Patching
§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up
§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor’s tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

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

§ 3.17 Royalties, Patents and Copyrights
The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturer is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.
§ 3.18 Indemnification
§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect’s consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys’ fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers’ compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT
§ 4.1 General
§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

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

§ 4.2 Administration of the Contract
§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner’s representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

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

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

§ 4.2.4 Communications
The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect’s services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect’s consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.
§ 4.2.5 Based on the Architect’s evaluations of the Contractor’s Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor’s submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect’s action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect’s professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect’s review of the Contractor’s submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect’s review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect’s approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner’s review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect’s responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect’s response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

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

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

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect’s response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.
ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions
§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work
§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor’s Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations
By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor’s Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts
§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

1. assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

2. assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.
When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor’s rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor’s compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor’s obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner’s Right to Perform Construction and to Award Separate Contracts

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

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner’s own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner’s own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

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

§ 6.2.2 If part of the Contractor’s Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor’s Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner’s or Separate Contractor’s completed or partially completed construction is fit and proper to receive the Contractor’s Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor’s delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor’s delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.
§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting andpatching as are described for the Contractor in Section 3.14.

§ 6.3 Owner’s Right to Clean Up
If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK
§ 7.1 General
§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders
§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:
   .1 The change in the Work;
   .2 The amount of the adjustment, if any, in the Contract Sum; and
   .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives
§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:
   .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
   .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
   .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
   .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:
Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work
The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME
§ 8.1 Definitions
§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.
§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion
§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time
§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or any other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION
§ 9.1 Contract Sum
§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values
Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment
§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.
§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner’s title to such materials and equipment or otherwise protect the Owner’s interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that the Work for which Certificates for Payment were previously issued and payments received from the Owner shall, to the best of the Contractor’s knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment
§ 9.4.1 The Architect will, within seven days after receipt of the Contractor’s Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor, or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect’s reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect’s reason for withholding certification in whole as provided in Section 9.5.1.

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

§ 9.5 Decisions to Withhold Certification
§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect’s opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect’s opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of
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1. defective Work not remedied;
2. third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
3. failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect’s decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments
§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

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

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor’s payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

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

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney’s fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.
§ 9.7 Failure of Payment
If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor’s Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days’ notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor’s reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

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

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

§ 9.8.3 Upon receipt of the Contractor’s list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect’s inspection discloses any item, whether or not included on the Contractor’s list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

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

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

§ 9.9 Partial Occupancy or Use
§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.
§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment
§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after substantial completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

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

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY
§ 10.1 Safety Precautions and Programs
The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property
§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to
employees on the Work and other persons who may be affected thereby;

2. the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

3. other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

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

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor’s obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor’s organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor’s superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property
If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances
§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor’s notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will
promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor’s reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect’s consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys’ fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor’s fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner’s fault or negligence.

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

§ 10.4 Emergencies
In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor’s discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS
§ 11.1 Contractor’s Insurance and Bonds
§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect’s consultants shall be named as additional insureds under the Contractor’s commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

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

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

§ 11.2 Owner’s Insurance
§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

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

§ 11.3 Waivers of Subrogation
§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect’s consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect’s consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.
§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance
The Owner, at the Owner’s option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner’s property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner’s property, due to fire or other hazards however caused.

§ 11.5 Adjustment and Settlement of Insured Loss
§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgage clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK
§ 12.1 Uncovering of Work
§ 12.1.1 If a portion of the Work is covered contrary to the Architect’s request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect’s examination and be replaced at the Contractor’s expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor’s expense.

§ 12.2 Correction of Work
§ 12.2.1 Before Substantial Completion
The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect’s services and expenses made necessary thereby, shall be at the Contractor’s expense.

§ 12.2.2 After Substantial Completion
§ 12.2.2.1 In addition to the Contractor’s obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during

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that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor’s correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor’s liability with respect to the Contractor’s obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work
If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law
The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction’s choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns
§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner’s rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies
§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.
§ 13.4 Tests and Inspections
§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner’s expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor’s expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest
Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT
§ 14.1 Termination by the Contractor
§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:
.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.
§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees, or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause
§ 14.2.1 The Owner may terminate the Contract if the Contractor
.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:
.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
.2 Accept assignment of subcontracts pursuant to Section 5.4; and
.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

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

§ 14.3 Suspension by the Owner for Convenience
§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent
.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience
§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall
.1 cease operations as directed by the Owner in the notice;
.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner’s convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES
§ 15.1 Claims
§ 15.1.1 Definition
A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims
The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims
§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance
§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker’s decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost
If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time
§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor’s Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.
§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages
The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

1. damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

2. damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party’s termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision
§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker’s sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner’s expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.
§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor’s default, the Owner may, but is not obligated to, notify the surety and request the surety’s assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is subject of a mechanic’s lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation
§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator’s fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration
§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.
§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

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

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

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.
SECTION 00 82 50 – ESCROW AGREEMENT

PART 1 - GENERAL

A. An escrow agreement is required by the Owner for retainage on this Project and is made a part of these Contract Documents by reference.

B. After award of the contract for this Project, the Contractor shall coordinate with the Owner to develop an escrow agreement.

END OF SECTION 00 82 50
PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY
   A. Section includes: Insurance requirements.

1.03 INSURANCE REQUIREMENTS
   A. The limits for Worker’s Compensation and Employers’ Liability Insurance shall meet statutory limits mandated by State and Federal laws.
   B. The limits for commercial General Liability insurance including coverage for Premises-Operations, Independent Contractors’ Protective, Products-completed Operations, Contractual Liability, Personal Injury and Broad Form Property Damage (including coverage for Explosion, Collapse and Underground Hazards) shall be as follows:
      1. $1,000,000.00 Each Occurrence.
      2. $1,000,000.00 Job Site Aggregate.
      3. $1,000,000.00 Personal and Advertising Injury.
      4. $1,000,000.00 Products-Completed Operations Aggregate.
         a. The policy shall be endorsed to have the Job Site Aggregate apply to this Project only. When a Job Site Aggregate endorsement is not available, provide a $2,000,000 General Aggregate.
         b. The Contractual Liability insurance shall include coverage sufficient to meet the obligations in AIA Document A201-1997.
         c. Products and Completed Operations insurance shall be maintained for a minimum period of at least two (2) years after either 90 days following Substantial Completion or final payment, whichever is earlier.
   C. Automobile Liability insurance (owned, non-owned and hired vehicles) for bodily injury and property damage shall be as follows:
      1. $1,000,000.00 Each Accident.
   D. Umbrella or Excess Liability coverage shall be as follows:
      1. $3,000,000.00 over primary insurance.
      2. $10,000.00 retention for self-insured hazards each occurrence.
SECTION 00 83 01 – CONTRACTOR QUALIFICATION

1.01 SUMMARY

A. The following applies to any bid for which the total of the base bid and all alternate bids is equal to or greater than $300,000. For bids less than $300,000 bidders are not required to be pre-qualified.

B. The Bidder, in executing the Bid Proposal, certifies as follows:

1. We, the Bidder of Record, are in compliance with all State of Indiana requirements regarding qualification of Contractors by the Indiana Department of Administration or INDOT, including but not limited to IC5-16-13, at the time and date provided in the Notice to Bidders for receipt of bids.

2. We have confirmed that any subcontractor or supplier which we have included in compiling our proposal, and with which we intend to complete a contract of $300,000 or greater, are in compliance with all State of Indiana requirements regarding qualification of Contractors by the Indiana Department of Administration or INDOT, including but not limited to IC5-16-13, at the time and date provided in the Notice to Bidders for receipt of bids.

3. We agree that in the case where we, subsequent to submitting the bid, enter into a contract of $300,000 or greater with a subcontractor or supplier for its efforts on the Work of this bid, we shall confirm that this entity is in compliance with all State of Indiana requirements regarding qualification of Contractors by the Indiana Department of Administration or INDOT, including but not limited to IC5-16-13, prior to entering such contract.

C. Requirements include but are not limited to:

1. Requirement that each General/Prime Contractor must self-perform, provide materials, and/or provide services in an amount of at least 15% of its contract price.

2. Requirement that each General/Prime Contractor, lower-tiered Sub-Contractor, lower-tiered Supplier, etc. must:

   a. Maintain general liability insurance with limits of at least $1,000,000/$2,000,000, and additionally as described in the Contract Documents.
   b. Be certified by the Indiana Certification Board or INDOT
   c. Comply with E-Verify.
   d. Not pay cash to any individual for work done on the public works project.
   f. Comply with worker’s compensation and occupational disease insurance requirements.
   g. Comply with unemployment compensation insurance requirements.
   h. Comply with State of Indiana drug testing requirements

D. Additional requirements for General/Prime Contractors and the Sub-Contractors and Suppliers that they contract with (defined as a “tier 2 Contractor”) that employs (50) or more journeymen:

1. Provide access to training program applicable to tasks to be performed in the normal course of the employee’s employment with the contractor.
2. Participate in apprenticeship training program that meets USDOL BAT standards.

E. Additional requirements that apply to public works contracts awarded after June 30, 2016:
   1. Preserve payroll and related records for (3) years after completion of the project work and make such records open to inspection by Department of Workforce Development.

END OF SECTION 00 83 01
SECTION 00 83 10 - EMPLOYEE SCREENING

GENERAL

1.01 SUMMARY

A. Employee Screening. E Bidder, in executing the Bid Proposal, certifies as follows:

1. We do hereby certify that all persons in our, our subcontractors, or our sub-subcontractors employ who will be present on the project site will be screened in accordance with Indiana Code 35-42-4-10. We will not permit the unlawful employment on this project site of a sexual predator by our forces, or by our subcontractors or sub-subcontractors.

2. We will notify the owner of any employees who have been convicted of felonies, violent, or drug related activities prior to allowing them on site. The owner may elect to refuse use of any such persons on this project with no further cause.

3. We will maintain a current list of approved screened personnel to be forwarded to the owner upon request.

4. We will provide identification tags/badges for all personnel working on the project site, and require them to be worn at all times. No person who has not been screened, and who does not meet the above criteria, shall be provided with an identification tag/badge.

B. The Bidder, in executing the Bid Proposal, agrees to provide an affidavit swearing and affirming that it does not knowingly employ unauthorized aliens.

1. E-Verify Compliance: Pursuant to I.C. 22-5-1.7, Contractor shall enroll in and verify the work eligibility status of all newly hired employees of Contractor through the E-Verify Program (Program). Contractor is not required to verify the work eligibility status of all newly hired employees through the Program if the Program no longer exists. Also pursuant to I.C. 22-5-1.7, Contractor must execute an affidavit affirming that the Contractor does not knowingly employ an unauthorized alien and confirming Contractor’s enrollment in the Program, unless the Program no longer exists, shall be filed with the Owner prior to the execution of this contract. This contract shall not be deemed fully executed until such affidavit is delivered to the Owner.

2. The Contractor and its subcontractors shall not knowingly employ or contract with an unauthorized alien or retain an employee or contract with a person that contractor or its subcontractor subsequently learns is an unauthorized alien. If Contractor violates this provision the Owner shall require Contractor to remedy the violation not later than thirty (30) days after the Owner notifies Contractor. If Contractor fails to remedy the violation within the thirty (30) day period, the Owner shall terminate the contract for breach of contract. If the Owner terminates the contract, Contractor shall be liable to the Owner for actual damages in addition to any other contractual remedies. There is a rebuttable presumption that Contractor did not knowingly employ an unauthorized alien if Contractor verified the work eligibility status of the employee through the Program.

3. Prior to performing any work, Contractor shall require each subcontractor to certify to Contractor that the subcontractor does not knowingly employ or contract with an unauthorized alien and has enrolled in the Program. Contractor shall maintain on file a certification from each subcontractor throughout the duration of this contract or project which is the subject of this contract. If Contractor determines that a subcontractor is in violation of this provision, Contractor may terminate its contract with the subcontractor for such violation.
4. Sample Affidavit Language:

The Contractor may provide an affidavit which the Contractor has developed for confirming participation in the E-Verify program. Alternatively the Contractor may use the following sample language as a guide to confirm participation on its letterhead. DO NOT SIGN AND SUBMIT THIS SPECIFICATION SECTION.

The undersigned being duly sworn upon (his/her) oath, now says that I, (name), (position) at (business entity), do hereby state that (business entity) does not knowingly employ unauthorized aliens and participates in the E-Verify Program when it hires new employees to confirm their work eligibility.

I swear or affirm, under the penalties for perjury, that the foregoing statements are true.

Do not sign this specification section
Signature of affiant
(include title and name of business entity)

END OF SECTION 008310
SECTION 00 83 11 – IRAN INVESTMENT ACTIVITIES

GENERAL

1.01 SUMMARY

A. Iran Investment Activities:

1. Pursuant to Indiana Code (IC) 5-22-16.5, Contractor certifies that Contractor is not engaged in investment activities in Iran. In the event the Owner determines during the course of this Agreement that this certification is no longer valid, the Owner shall notify Contractor in writing of said determination and shall give contractor ninety (90) days within which to respond to the written notice. In the event Contractor fails to demonstrate to the Owner that the Contractor has ceased investment activities in Iran within ninety (90) days after the written notice is given to the Contractor, the Owner may proceed with any remedies it may have pursuant to IC 5-22-16.5. In the event the Owner determines during the course of this Agreement that this certification is no longer valid and said determination is not refuted by Contractor in the manner set forth in IC 5-22-16.5, the Owner reserves the right to consider the Contractor to be in breach of this Agreement and terminate the agreement upon the expiration of the ninety (90) day period set forth above.

END OF SECTION 00 83 11
SECTION 01 01 00 – SUMMARY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Access to site.
   4. Work restrictions.
   5. Preliminary Schedule.

B. Related Section:
   1. Division 1 Section “Project Management and Coordination” for requirements for meetings, scheduling, and general coordination.

1.03 PROJECT INFORMATION

A. Project Identification: Early Childhood Center

   1. Project Location:
      Early Learning Center
      314 West Main Street,
      Fountain City, IN 47314

   2. Owner (Corporate Administration):
      Northeastern Wayne School Corporation
      Office of the Superintendent of Schools,
      7295 N US Highway 27
      Fountain City, IN 47341

   3. Architect/Engineer:
      Stair Associates, Inc.    Phone:   (317) 228-1900
      9641 Commerce Dr.       Fax:   (317) 228-1700
      Carmel, IN 46032

      Contact: Woody Holm – Partner /Engineer: woody@stairnet.biz
                Martin Truesdell – Architect: martin@stairnet.biz
                Randy Stair – Partner: randy@stairnet.biz
1.04 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work shall be completed under (1) Prime Contract with the Owner including but not limited to:

1. Site Work:
   a. Minimal, as required for building addition
   b. Lawn restoration.

2. General Construction:
   a. Footings and foundations,
   b. Infill of existing mechanical room,
   c. Unit Masonry,
   d. Metal Studs and Gypsum Board,
   e. Aluminum Windows,
   f. Doors, frames and hardware,
   g. Finishes,

3. Mechanical, Electrical, and Plumbing work:
   a. Removal of existing mechanical system,
   b. Provision of new mechanical system in mezzanine.
   c. Renovation of existing and provision of new toilet rooms,
   d. Electrical Work.

1.05 ACCESS TO SITE

A. Use of Site: Limit use of the Work site to areas immediately adjacent to the work. Do not disturb portions of Work site beyond areas as required for execution of the Work.

1. Driveways, Walkways and Entrances: Keep driveways, sidewalks, and entrances serving premises clear and available to emergency vehicles at all times. Do not use these areas for parking or storage of materials.

1.06 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours:

1. Any short duration work which creates excessive noise or otherwise is potentially disruptive to local residents shall be conducted between the hours of 8:00 a.m. and 5:00 p.m. on weekdays.

C. Nonsmoking Job Sites: Smoking or use of smokeless tobacco products is not permitted ANYWHERE on the Owner’s property.

1. Controlled Substances: Use of tobacco products and other controlled substances is not permitted on school property.

1.07 GENERAL PROVISIONS

A. All work performed under this contract is to be complete and finished, with all required accessories, installation of new equipment, cutting, patching, paint, etc., as necessary for an obviously finished product. Furnish and install all such items required.
B. Prior to starting construction, the prime contractor shall arrange a meeting at the job site with his project superintendent, the Architect-Engineer, and the Owner's rep. to review the work to be done, and discuss the schedule for completion. From this point on, initial contract work shall be coordinated to run continuously to completion, subject only to material deliveries, weather conditions and strikes. The Job Superintendent shall report any delays immediately to the Architect/Engineer.

C. Contractors and Subcontractors shall receive instructions and interpretations from the Architect/Engineer and designated Owner's representatives ONLY.

D. The Prime Contractor shall be responsible for project scheduling, sequencing and coordination of work between all prime contractors. The Prime Contractor shall have a superintendent on site and equipped with a mobile phone equipped with email whenever its forces or its subcontractors are working on site.

1.08 SCHEDULE

A. Schedule, all dates 2019 UNO:
1. First Advertisement – November 15.
2. Documents ready for distribution: November 18.
5. School Board meeting to accept bids – December 18.

B. Preliminary Owner’s preferred Construction schedule, all dates 2020:
4. Owner Occupancy – July 19. This date is not negotiable.

C. Special note relative to substantial completion:
1. The Owner shall begin setting up the building for use as its Early Childhood program beginning on or before July 19, 2020. The Owner has no option for alternative facilities. It is imperative that the Work be complete and ready for Owner occupancy and set up no later than this date. Work on minor punch list items may continue until July 31, 2020. Extension of the Work beyond these dates shall not be acceptable for any reason.
2. It is imperative that the Work be complete in time to allow occupancy for the Owner’s Fall term. The Contractor shall be responsible for “making-up” the schedule should any conditions beyond its control arise to cause temporary delay.

END OF SECTION 01 01 00
SECTION 01 02 60 - UNIT PRICES

PART 1 - GENERAL

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

1.02 SUMMARY
   A. This Section includes administrative and procedural requirements for unit prices.
   B. Related Sections: The following Sections contain requirements that relate to this Section:
      1. Division 4 Section "Unit Masonry Assemblies"

1.03 DEFINITIONS
   A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if the estimated quantities of Work required by the Contract Documents are increased or decreased.

1.04 PROCEDURES
   A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, profit, and applicable taxes.
   B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices.
   C. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this work measured, at the Owner's expense, by an independent surveyor acceptable to the Contractor.

1.04 PRICING
   A. Unit pricing for tuck pointing.
      1. The same unit price shall be used for work added or subtracted from the contract.
      2. Unit pricing shall be for work as described in Specifications Section 04 81 00.
      3. The Base Bid shall include tuck pointing of seventy five (75) square feet of brick surface area. The bidder shall include in its pricing the cost for scaffolding for work immediately below the existing gutter line. Should less than this amount of tuck pointing be required, the cost shall be deducted from the contract.
      4. The Owner/Design Professional shall meet with the Contractor on site subsequent to the bid to define the extent of tuck pointing required.

PART 2 - PRODUCTS (Not Applicable)
PART 3 – EXECUTION (Not Applicable)

END OF SECTION 01 02 60
SECTION 01 10 00 - ALTERNATE BIDS

PART 1 - GENERAL

1.01 Required Alternates. Owner reserves the right to accept any, all, or none of the alternate bids. The order listed is not indicative of the order of preference. Alternate bid prices may be accepted with original contract or may be held for future acceptance. Any price held for future acceptance will be accepted prior to start of any work or before approval of any affected shop drawings.

1.02 Each bidder must provide a bid for all Alternates associated with its Base Bid in order for their Base Bid to be considered.

1.02 Alternate bids shall be indicated on the bid form as the sum to be added to or deducted from the Base Bid number. In example: for a Base Bid of $100,000 with an Add Alternate of $10,000 the number indicated as the alternate bid on the bid form shall be $10,000, NOT $110,000.

PART 2 - SCHEDULE OF ALTERNATES

2.01 GENERAL CONSTRUCTION

A. Alternate Bid #1: Windows. Indicate additional cost to remove existing windows and provide new windows to meet specifications for new windows at existing window openings.
   1. Base Bid: Provide windows at all new openings as indicated on the constructions documents. Retain existing windows in place.

B. Alternate Bid #2: Re-roof Existing Building. Indicate additional cost to replace existing asphalt shingle roof, including removal of existing shingles and roof system to the roof deck.
   1. Base Bid: Existing asphalt shingle roof to remain. Base bid shall include any work relative to roof penetrations including but not limited to mechanical and plumbing vents. Base Bid shall also include materials and labor to tie new construction roof into existing roof system.

C. Alternate Bid #3: Solid Surface: Indicate cost to provide Solid Surface Material SS1 in all locations where Plastic Laminate PL2 is indicated.
   1. Base Bid: Provide plastic laminate PL2. Base Bid includes solid surface at toilet room, see drawings.

D. Alternate Bid #4: Paint Existing EIFS: Indicate cost to prepare and paint all existing exterior EIFS surfaces, including but not limited to existing window infill, soffits, and gable ends. NOTE: provide paint which is compatible with EIFS surface and prepare surface as recommended by EIFS manufacturer.
   1. Base Bid: Lightly pressure wash existing EIFS surfaces taking care to avoid damaging EIFS surface.

END OF SECTION 01 10 00
SECTION 01 15 00 – AFFIDAVIT, RELEASE AND WAIVER OF LIEN

State of Indiana, SS:

County of __________________________

_________________________ being duly sworn states that they are the ________________ of __________________________ having contracted with the NORTHEASTERN WAYNE SCHOOL CORPORATION to furnish certain materials and/or labor as follows: All Project requirements including but not limited to labor and material for the project known as Northeastern Wayne School Corporation – Early Childhood Center located in Fountain City, Indiana and hereby does further state on behalf of the aforementioned Subcontractor.

(PARTIAL WAIVER) that the balance due from the contractor is the sum of:

_________________________ DOLLARS $ __________________________

☐ Receipt of which is hereby acknowledge; or

☐ The payment of which has been promised as the sole consideration for this Affidavit and Partial Waiver of Lien, which shall become effective upon receipt of such payment.

(FINAL WAIVER) that the final balance due from the contractor is the sum of:

_________________________ DOLLARS $ __________________________

☐ Receipt of which is hereby acknowledge; or

☐ The payment of which has been promised as the sole consideration for this Affidavit and Final Waiver of Lien, which shall become effective upon receipt of such payment.

Therefore, the undersigned waives and release unto the Owner of said premises, and all lien or claim whatsoever on the above-described property and improvements thereon on account of Labor or Material, or both, furnished to the undersigned thereto, and further certifies that no other party has any claim or right to a lien on account of any work performed or material furnished to the undersigned for said project, and within the scope of this Affidavit and Waiver.

BY: ________________________________

WITNESS MY HAND AND NOTARIAL SEAL, this ______ day of ________, 20____

______________________________  My Commission Expires: ______________________
SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Contingency allowances to be included in the Base Bids. Itemize allowances on schedules of values.

1.03 SELECTION AND PURCHASE

A. Purchase products and systems selected by Architect from the designated supplier.

1.04 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

D. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.05 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.06 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Wages included in allowances shall not exceed published union wages for the specific trades, including benefits, in the county where the Work occurs.

C. Contractor's overhead, profit, and related costs for work, products and equipment ordered by Owner under a cash or contingency allowance shall be included in the Contractor's original
bid price. No additional overhead, profit, and related costs for products and equipment shall be included in the cost of items or services funded from these allowances.

D. At Project closeout, unused amounts remaining in these allowances shall be credited to the Owner by Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.02 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials to ensure that each allowance item is completely integrated and interfaced with related work.

3.03 SCHEDULE OF ALLOWANCES

A. Contingency Allowance No. 1: Include in the Base Bid $45,000 for the remediation of discovered conditions as directed by the Owner.

END OF SECTION 01 21 00
SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on the Project including, but not limited to, the following:
   1. General project coordination procedures.
   2. Administrative and supervisory personnel.
   3. Requests for Information (RFIs).
   4. Pre-construction and progress meetings.

1.03 CRITICAL PATH SCHEDULE

A. Initial Proposed Outline Schedule:
   1. Develop and present to the Owner and Design Professional for approval an outline Proposed Critical Path Schedule within 5 calendar days of bid opening. This schedule shall include but not be limited to:
      a. Procurement of permits and releases for each Bid Group.
      b. Mobilization.
      c. Construction activities which shall occur within the existing building including start times and durations. Including but not limited to gas, fire suppression and electrical.
      d. Completion of fire alarm, fire suppression, and other requirements for occupancy by building unit.

1.04 DEFINITIONS

A. RFI: Request from the Owner, Architect, or Contractor seeking information from each other during construction.

1.05 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, which depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Recording, processing and distributing progress meeting minutes.
   7. Pre-installation conferences.
   8. Project closeout activities.
   9. Startup and adjustment of systems.
   10. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

1.06 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit a RFI in the form specified.
   1. Architect will return RFIs submitted to the Architect by other entities controlled by Contractor with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Project number.
   3. Date.
   4. Name of Contractor.
   5. Name of Architect
   6. RFI number, numbered sequentially.
   7. RFI subject.
   8. Specification Section number and title and related paragraphs, as appropriate.
   9. Drawing number and detail references, as appropriate.
   10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
   a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow four (4) working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
   1. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
   
D. On receipt of Architect's action, immediately distribute the RFI response to affected parties. Review response and notify Architect within three (3) workdays if Contractor disagrees with response.

1.07 PROJECT MEETINGS

A. Preconstruction Meeting: There shall be a Pre-construction meeting as soon as practical after receipt of bids. The Contractor shall assure that its site foreman as well as foremen for the primary Sub-Contractors are in attendance. Foremen must be familiar with the project, and be able to make commitments regarding schedule.

B. General: Schedule and conduct conferences at Project site, unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: The Contractor is responsible for conducting meetings and shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three (3) working days of the meeting.

C. Progress Meetings: The Contractor shall conduct progress meetings at biweekly intervals.
   1. Coordinate dates of meetings with preparation of payment requests.
   2. Attendees: In addition to representatives of Owner, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind
schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Status of submittals.
2) Site utilization.
3) Temporary facilities and controls.
4) Status of RFI's.
5) Status of proposal requests.
6) Pending changes.
7) Status of Change Orders.
8) Pending claims and disputes.
9) Documentation of information for payment requests.

4. Minutes: The Contractor shall record and distribute the meeting minutes to each party present and to parties requiring information.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00
SECTION 01 34 00 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes requirements for submitting Shop Drawings, Product Data, Samples, to the Architect for review.

B. Related Sections:

1. Divisions 2 through 17 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.03 DEFINITIONS

A. Shop Drawings: Original drawings prepared by the Contractor, Subcontractor, Supplier and/or Distributor, illustrating some portion of the Work – showing fabrication, layout, setting and/or installation details.

B. Product Data: Manufacturer’s catalogs, brochures, diagrams, schedules, performance charts, illustrations and standard descriptive details and/or information.

C. Samples: Physical samples required to illustrate materials, equipment and/or workmanship and to establish standards by which the completed Work will be evaluated.

1.04 SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in order by specification section showing dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Remaining submittals shall be per the approved submittal schedule.

4. Format: Arrange the following information in a tabular format:

   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Submittal category: Action, informational.
   d. Name of subcontractor.
   e. Description of the Work covered.
   f. Scheduled date for Architect's final release or approval.
g. Scheduled dates for purchasing.
h. Scheduled dates for installation.
i. Activity or event number.

1.05 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section as indicated on approved submittal schedule.
3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals or resubmittals enough in advance of the Work to permit processing.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow 15 days for review of each resubmittal.
3. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 15 days for initial review of each submittal.

C. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:
   a. Project name.
   b. Date.
   c. Name of Architect.
   d. Name of Contractor.
   e. Name of subcontractor.
   f. Name of supplier.
   g. Name of manufacturer.
   h. Submittal number or other unique identifier, including revision identifier.
   i. Number and title of appropriate Specification Section.
   j. Drawing number and detail references, as appropriate.
   k. Location(s) where product is to be installed, as appropriate.
   l. Other necessary identification.

D. Options: Identify options requiring selection by the Architect.
E. Deviations: Identify deviations from the Contract Documents on submittals.

F. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

G. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, if received from sources other than Contractor.

1. Transmittal Form: Provide locations on form for the following information:
   a. Project name.
   b. Date.
   c. Names of subcontractor, manufacturer, and supplier.
   d. Specification Section number and title.
   e. Drawing number and detail references, as appropriate.
   f. Transmittal number.
   g. Remarks.
   h. Signature of transmitter.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Unless otherwise directed by the Architect, resubmit submittals until they are marked with approval notation from Architect's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.

**PART 2 - PRODUCTS**

2.01 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 1 Section "Closeout Procedures."

2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

3. Test and Inspection Reports Submittals: Comply with requirements specified in Division 1 Section "Testing Laboratory Services."
B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.
   c. Standard color charts.
   d. Statement of compliance with specified referenced standards.
   e. Testing by recognized testing agency.
   f. Application of testing agency labels and seals.
   g. Notation of coordination requirements.
   h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
   a. Three paper copies of Product Data, unless otherwise indicated. Architect will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:
   a. Three (3) opaque copies of each submittal. Architect will return two (2) copies.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of applicable Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit one (1) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit three (3) sets of Samples. Architect will retain one (1) Sample set(s).
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW
   A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
   B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 1 Section "Closeout Procedures."
   C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of
reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Shop Drawing, Product Data and Sample Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate Architect’s action.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are not acceptable, will be considered non-responsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 34 00
STAIR ASSOCIATES, INC.

SECTION 01 37 00 – SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 REQUIREMENTS

A. Submit to Architect-Engineer a Schedule of Values allocated to the various portions of work within ten (10) days after award of the Contract. This Schedule of Values, after approval by the Architect/Engineer, shall be the basis for applications for payment. See General Conditions Article 9.2.

B. A separate schedule shall be submitted on AIA Document G702, and G703, Continuation Sheet, and must include breakdown for subcontractors.

C. G702 shall be filled out complete, except for application dollar amounts.

D. G703 shall have values listed for all items that are specified in separate sections of the specifications.

E. If applicable, each allowance as listed in Section 01 02 00 shall be listed as a separate line item.

1.03 ADDITIONAL REQUIREMENTS FOR DIVISION OF WORK

A. Provide information as noted above, and additionally
   1. Provide one or more line item value(s) for the work of any Sub-Contractor listed in Section 00 40 00 Subcontractors and Suppliers.
   2. Provide one or more line item value(s) for each Specification Division.
   3. Provide one or more individual line item value(s) for any portion of the work which totals more than (10%) ten percent of the total contract amount.
   4. Divide any portion of the work totaling more than (25%) twenty five percent of the total contract amount into three or more component line item values.
      a) In work which is limited in scope the Architect/Engineer may elect to allow larger component values.

END OF SECTION 01 37 00
PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
   B. This section includes waste removal.
   C. The Contractor shall be responsible for Temporary Facilities and Controls relative to its Work.
      1. Telephone and e-mail on site.
         a. The Contractor shall provide a cell phone with e-mail capability.
      2. Environmental Protection not specifically called out in the bid documents but required for the work.
      3. Cellular phone available to contact Job Forman at all times.
   D. The Contractor shall be responsible for:
      1. Sanitary facilities.
      2. Environmental Protection including coordination with and approvals from all entities with jurisdiction over the site.
      3. Security Fence: Provide a minimum (5) foot tall chain link security fence with access gate to restrict unauthorized persons for entering the work area. This fence shall enclose both Work and lay-out areas.
         a. Materials within the building may be secured by securing the building.
   E. Related Sections:
      1. Division 1 Section "Summary" for limitations on work restrictions and utility interruptions.
      2. Division 1 Section “Temporary Utilities” for construction utility requirements.

1.03 TEMPORARY FACILITIES
   A. Sanitary Facilities:
      1. The Contractor shall provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
      2. The existing sanitary facilities may be used until they are removed for renovation.

1.04 WASTE REMOVAL
   A. The Contractor shall be responsible for its own waste removal.
1.05 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. The Prime Contractor shall secure any equipment, materials, tools or other items such that non-authorized persons are not allowed access.
   1. Ladders, lifts or other such items must not be left unattended when not in use.
      a. Do not leave ladders where they could be used by unauthorized persons to access the roof.
   2. Hand tools must be secured.

B. Environmental Protection: The Prime Contractor shall provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1.06 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility
   1. Materials and facilities that constitute temporary facilities are property of Contractor.
   2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period.

END OF SECTION 01 50 00
SECTION 01 50 10 - TEMPORARY UTILITIES

PART 1 - TEMPORARY ELECTRICAL, WATER AND HEAT

1.01 Temporary Electrical Service:
   A. Electric Power Service: Electric power from the Owner’s existing system is available for use for temporary lighting and temporary power without metering and without payment of use charges.
      a. The existing system shall be disconnected for some period during the Work. The Contractor shall be responsible for providing its own service at its expense during this period.

1.02 Temporary Water Service:
   A. Water Service: Water from the Owner’s existing system is available for use without payment of use charges. The Contractor shall provide connections and extensions of services as required for the Work.
      a. The existing system shall be disconnected for some period during the Work. The Contractor shall be responsible for providing its own service at its expense during this period.

1.03 Temporary Heat:
   A. The existing mechanical system shall be removed. The Contractor shall provide any temporary heat required for its Work at the Contractor’s expense.

PART 2 - TEMPORARY FIRE PROTECTION

2.01 The Contractor shall be responsible for Temporary Fire Protection.
   A. All precautions against fire shall be in full compliance with requirements of the Owner's insurance policies, in addition to requirements of Subparagraph 10.2.2 of the General Conditions.
   B. The Contractor shall contact the appropriate fire official prior to beginning the work and discuss work related to the fire suppression system as well as any other pertinent concerns.
   C. If required by the local fire official, fire extinguishers in sufficient numbers for protection of the Work shall be provided and maintained by the Contractor. Extinguishers shall be of approved manufacture and capacity, shall be pretested and recorded, and shall be water type, for use on general rubbish, and CO₂ or Ansul Type, for use on oily materials or electrical equipment, in numbers of each type as required.

2.02 No gasoline, benzine or other hazardous combustible or explosive materials shall be stored within 100 feet of the buildings at the Work site. Empty containers and all oily, solvent or paint soaked rags shall be removed from the Work site at close of each day's work.

2.03 Welding and flame cutting equipment shall be of approved first quality materials, and subject to code. Provide firewatchers and fire extinguishers whenever welding, cutting or burning is being done.

END OF SECTION 01 50 10
SECTION 01 57 00 – HOUSEKEEPING AND SAFETY

PART 1 - GENERAL

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

1.02 PURPOSE  
A. The purpose of this section is to define and emphasize the responsibilities of the Contractor to keep the work site orderly, clean and safe for everyone.  
B. Related Sections:  
   1. Division 1 Section “Final Cleaning” for additional requirements.

1.03 HOUSEKEEPING REQUIREMENTS  
A. Housekeeping Requirements include the building site and all access roads including both the Owner’s property and public ways. Dirt, dust and debris must be removed from roads and sidewalks at the end of each working day.  
B. The Contractor shall perform daily housekeeping to keep its work, the site and adjacent properties free from accumulations of construction operations and as follows:  
   1. Clean up all waste materials, equipment, rubbish and debris resulting from their operations.  
   2. Organize and secure materials, equipment and offices in assigned areas. Maintain administrative areas in an orderly fashion to facilitate the sequence of construction.  
   3. Repair, patch and/or touch up marred surfaces to match adjacent finishes damaged by their housekeeping operations.  
   4. Leave all work areas in a “broom clean” condition at the completion of each workday.  
   5. Participate in joint clean up efforts as directed by the Design Professional or Owner.  

1.04 SAFETY REQUIREMENTS  
A. The Contractor is responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of its work including, but not limited to, the following:  
   1. Protection of its employees and those around them that may be affected by their work.  
   2. Providing and maintaining an up-to-date HAZCOM and safety plan on file in the general contractor’s job trailer. MSDS must be kept current for all materials utilized on the job site.  
   3. Identifying and notifying the Design Professional, Owner and all construction personnel of hazards whether a result of its own operations or operations affecting or which may affect its employees and other personnel on the job site.  
   4. Contractor will employ and identify a “competent person” as defined by OSHA for each of its operations in accordance with OSHA regulations.
PART 2 - PRODUCTS

2.01 MATERIALS
   A. Use cleaning materials only on surface(s) to be cleaned and as recommended by the cleaning material manufacturer for said surface.
   B. Use only those cleaning materials that will not create hazards to health or property and that will not damage adjacent surfaces not intended or required to be cleaned.
   C. Contractor shall provide its own cleaning materials and equipment.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION
   A. Perform cleaning activities as required to insure that the building, grounds, public and adjacent properties are maintained free from accumulations of waste materials and rubbish.
   B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
   C. Do not leave trash and debris uncontained in the building or on the site overnight.
   D. Daily during progress of work, clean the site and adjacent properties which may be affected by construction activities and deliver waste materials, debris and rubbish to dumpster(s).
   E. Remove all debris from concealed spaces before permanently enclosing space.
   F. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw materials from heights.
   G. Schedule cleaning operations so that dust and other airborne contaminants resulting from the cleaning process will not fall on wet, newly painted surfaces and/or affect the performance of the HVAC systems.
   H. Store volatile wastes in covered containers approved for material to be stored and remove from site daily.
   I. Prevent accumulation of wastes that create hazardous conditions.
   J. Provide adequate natural or mechanical ventilation during the use of volatile or noxious substances.
   K. Conduct cleaning and disposal operations to comply with all applicable local ordinances and anti-pollution laws.
      1. Do not burn or bury waste materials on the project site.
      2. Do not dispose of volatile wastes in storm and/or sanitary sewers.
      3. Do not dispose of wastes into any water resource.
   L. Clean exposed finished surfaces and protect as required to maintain these free from damage and deterioration through the duration of the project.

END OF SECTION 015700
SECTION 01 71 00 – FINAL CLEANING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary
      Conditions and Division 1 Specification Sections, apply to this Section.
   B. Related Sections:
      1. Division 1 Section “Housekeeping and Safety” for additional requirements.

PART 2 - PRODUCTS

2.01 MATERIALS
   A. Use cleaning materials only on surface(s) to be cleaned and as recommended by the cleaning
      material manufacturer for said surface.
   B. Use only those cleaning materials that will not create hazards to health or property and that
      will not damage adjacent surfaces not intended or required to be cleaned.
   C. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

PART 3 - EXECUTION

3.01 FINAL CLEANING
   A. The Contractor shall be responsible for final cleaning relative to its scope of work.
   B. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply
      with local laws and ordinances and Federal and local environmental and antipollution
      regulations.
   C. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean
      each surface or unit to condition expected in an average commercial building cleaning and
      maintenance program. Comply with manufacturer's written instructions.
      1. Complete the following cleaning operations before requesting inspection for certification
         of Substantial Completion for entire Project or for a portion of Project:
         a. Clean Project site, yard, and grounds, in areas disturbed by construction activities,
            including landscape development areas, of rubbish, waste material, litter, and other
            foreign substances.
         b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other
            foreign deposits.
         c. Rake grounds that are neither planted nor paved to a smooth, even-textured
            surface.
         d. Remove tools, construction equipment, machinery, and surplus material from
            Project site.
         e. Remove snow and ice to provide safe access to building.
         f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition,
            free of stains, films, and similar foreign substances. Avoid disturbing natural
            weathering of exterior surfaces. Restore reflective surfaces to their original
            condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

h. Sweep concrete floors broom clean in unoccupied spaces.

i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

k. Remove labels that are not permanent.

l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

n. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

q. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.


r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

s. Leave Project clean and ready for occupancy.

D. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests.

E. Construction Waste Disposal: Comply with waste disposal requirements in Division 1 Section "Temporary Facilities and Controls."

END OF SECTION 01 71 00
SECTION 01 73 10 - CUTTING AND PATCHING

PART 1 - GENERAL

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

1.02 SUMMARY
   A. This Section includes procedural requirements for cutting and patching.
      1. Each Contractor and Subcontractor whose work requires it, shall be responsible for all cutting (including excavation), filling and/or patching of Work required to:
         a. Make several parts fit together properly or to receive work of other contractors and/trades.
         b. Uncover portions of the Work to provide for installation of ill-timed work.
         c. Remove and replace defective Work.
         d. Remove and replace Work not conforming to the Contract Documents.
         e. Provide routing penetrations of non-structural surfaces for installation of piping and electrical conduit.
         f. Remove samples of installed Work as specified for testing.
         g. Maintain all smoke and fire-rated assemblies, unless otherwise directed by the Contract Documents and/or with written approval from the Design Professional.
      2. In addition to the Contract Documents, upon written instruction from the Design Professional:
         a. Uncover work to provide for observation of covered work.
         b. Remove samples of installed materials for testing.
      3. Do not endanger Work by cutting and/or altering any part of said Work.
      4. Do not cut, alter and/or remove Work of another Contractor without written consent from said contractor.
   B. Related Sections include the following:
      1. Division 1 Section "Selective Demolition" for demolition of selected portions of the building.
      2. Divisions 2 through 17 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.03 DEFINITIONS
   A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
   B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.
1.04 QUALITY ASSURANCE
   A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
      1. Obtain written approval from the Structural Engineer of Record prior to commencement of cutting and patching work on all structural elements.
   B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
      1. Primary operational systems and equipment.
      2. Air or smoke barriers.
      3. Fire-suppression systems.
      4. Mechanical systems piping and ducts.
      5. Control systems.
      6. Communication systems.
      7. Conveying systems.
      8. Electrical wiring systems.
   C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, which results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.
      1. Water, moisture, or vapor barriers.
      2. Membranes and flashings.
      3. Exterior curtain-wall construction.
      4. Equipment supports.
      5. Piping, ductwork, vessels, and equipment.

1.05 WARRANTY
   A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 MATERIALS
   A. General: Comply with requirements specified in other Sections.
   B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
      1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.
B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

3.03 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.
C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 10
SECTION 01 73 20 - SELECTIVE DEMOLITION

PART 1 - GENERAL

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

1.02 SUMMARY
   A. This Section includes the following:
      1. Demolition and removal of selected portions of building or structure.
      2. Demolition and removal of selected site elements.
      3. See demolition sheets of the Construction Drawings for additional information regarding demolition.
   B. Related Sections include the following:
      1. Division 1 Section "Summary" for use of premises and Owner-occupancy requirements.
      2. Division 1 Section “Cutting and Patching” for additional requirements.
   C. NOTE: The Owner shall remove hazardous materials by separate contract prior to the beginning of the work.

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

1.04 MATERIALS OWNERSHIP
   A. It is not anticipated that any items of historical significance will be encountered. Should any items be revealed which the Contractor may reasonably believe to be relevant, contact the Owner’s representative immediately.

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

1.06 PROJECT CONDITIONS
   A. Owner will maintain conditions existing at time of inspection for bidding purpose as far as practical.
   B. Notify Design Professional of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Design Professional and Owner. Owner will remove hazardous materials under a separate contract.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION
3.01 EXAMINATION
A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

B. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Design Professional.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS
A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
   1. Comply with requirements for existing services/systems interruptions specified in Division 1 Section "Summary."

3.03 PREPARATION
A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1 Section "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.04 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.

   a. **DO NOT** use open flame when the Owner’s personnel are in the building.

4. Maintain adequate ventilation when using cutting torches.

5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

8. Dispose of demolished items and materials promptly.

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

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

E. Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Refer to Division 7 Section "Thermal and Moisture Protection" for new roofing requirements.

   1. Remove existing roof membrane, flashings, copings, and roof accessories.
   2. Remove existing roofing system down to substrate.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

   A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of.

      1. Do not allow demolished materials to accumulate on-site.
      2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

   B. Burning: Do not burn demolished materials.

   C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.07 CLEANING

   A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 01 73 20
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including,
   but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.

B. Related Sections:
   1. Division 1 Section “Final Cleaning” for additional requirements.
   2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance
      manual requirements.
   3. Division 1 Section “Warranties and Guarantees” for additional requirements.
   4. Divisions 2 through 28 Sections for specific closeout and special cleaning requirements
      for the Work in those Sections.

1.03 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial
   Completion, complete the following. List items below that are incomplete with request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on
      the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final
      certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to
      services and utilities. Include occupancy permits, operating certificates, and similar
      releases.
   5. Prepare and submit Project Record Documents, operation and maintenance manuals, final
      completion construction photographic documentation, damage or settlement surveys,
      property surveys, and similar final record information.
   6. Deliver tools, spare parts, extra materials, and similar items to location designated by
      Owner. Label with manufacturer's name and model number where applicable.
   7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's
      personnel of changeover in security provisions.
   8. Complete startup testing of systems.
   10. Terminate and remove temporary facilities from Project site, along with mockups,
       construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.04 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.05 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Architect.
d. Name of Contractor.
e. Page number.

4. Submit list of incomplete items in the following format:
a. Three (3) paper copies of product schedule or list, unless otherwise indicated. Architect will return two (2) copies.

1.06 Warranties

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. See Division 1 Section “Final Cleaning” for additional final cleaning requirements.

END OF SECTION 01 77 00
PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section includes administrative and procedural requirements for project record documents, including the following:
      1. Record Drawings.
      2. Record Specifications.
   B. Related Sections:
      1. Division 1 Section "Closeout Procedures" for general closeout procedures.
      2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
      3. Divisions 2 through 17 Sections for specific requirements for project record documents of the Work in those Sections.

1.03 MAINTAINING RECORD DOCUMENTS
   A. The Contractor shall keep (1) set of record documents consisting of a clean and well maintained set of contract drawings relative to its scope of work.
      1. Record documents shall NOT be used as one of the jobsite sets.
      2. Record drawings shall be maintained in the General Contractor’s trailer or in a location provided by the Project Owner.
   B. The General Contractor shall be responsible for assuring that all Sub-Contractor’s update these documents at any time a notable change or discovery occurs, and minimally (1) time every (2) weeks.
   C. The Record Documents shall be reviewed at each Progress Meeting.
   D. The Contractor shall maintain a binder which includes color copies of all approved Shop Drawings and Submittals.
      1. All mark-ups and revisions shall be included in the binder.
      2. The Binder shall NOT be used for construction purposes.
      3. The Binder shall be maintained in the General Contractor’s trailer or in a location provided by the Project Owner.
      4. At the conclusion of the work the binder shall serve as the record document for the specifications.
PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

A. Markings shall be clearly legible:
   1. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
   2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
   3. The Contractor may elect to generate typed or word processed notes to be taped to the paper sets. If the printed notes are not sufficiently legible the Contractor shall be required to use this method.

B. Record Prints: Maintain one (1) set of marked-up paper copies of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity that obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information using a drawing/printing technique acceptable to the Design Professional.
         1) Review recording of information with the Design Professional no later than the second regular progress meeting.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding archive photographic documentation.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations below first floor.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.
      k. Changes made following Design Professional's written orders.
      l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.

n. Record information on the Work that is shown only schematically.

3. Mark important additional information that was either shown schematically or omitted from original Drawings.

4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.02 RECORD DOCUMENT DELIVERABLE

A. Record Drawings: The Contractor shall assemble a set of Record Drawings:

1. Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Design Professional.

2. Format: Identify and date each record Drawing sheet; include the designation "PROJECT RECORD DRAWING" in a prominent location.

3. Upon approval from the Design Professional the General Contractor shall:
   a. Scan the marked up drawings into a PDF format.
   b. Assure that all marking are clearly legible as scanned.

4. Record hard copy file: Deliver (2) printed and bound hard copies to the Design Professional for transfer to the Owner.

5. Record Digital Drawing File: Deliver (2) digital copies to the Design Professional for transfer to the Owner:

6. Coordinate with the Owner regarding preferred format for the digital copies.

B. Record Specifications: The Prime Contractor shall scan the record shop drawings contained in the required binder into a PDF format.

1. Record hard copy file: Deliver (2) printed and bound hard copies to the Design Professional for transfer to the Owner.

2. Record Digital Drawing File: Deliver (2) digital copies to the Design Professional for transfer to the Owner:

3. Coordinate with the Owner regarding preferred format for the digital copies.

END OF SECTION 01 78 10
SECTION 01 78 20 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section includes administrative and procedural requirements for preparing operation and
      maintenance manuals, including the following:
      1. Operation and maintenance documentation directory.
      2. Emergency manuals.
      3. Operation manuals for systems, subsystems, and equipment.
      4. Product maintenance manuals.
      5. Systems and equipment maintenance manuals.
   B. Each Prime contractor shall provide their own Operation and Maintenance data.
   C. Related Sections:
      1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for
         operation and maintenance manuals.
      2. Division 1 Section "Closeout Procedures" for additional requirements.
      3. Division 1 Section “Warranties and Guarantees” for additional requirements.
      4. Divisions 2 through 17 Sections for specific operation and maintenance manual
         requirements for the Work in those Sections.

1.03 RESPONSIBILITY
   A. The Contractor shall be responsible for Closeout Procedures relative to its scope of work.

1.04 DEFINITIONS
   A. System: An organized collection of parts, equipment, or subsystems united by regular
      interaction.
   B. Subsystem: A portion of a system with characteristics similar to a system.

1.05 CLOSEOUT SUBMITTALS
   A. Manual Content: Operations and maintenance manual content is specified in individual
      specification sections to be reviewed at the time of Section submittals. Submit reviewed
      manual content formatted and organized as required by this Section.
      1. Where applicable, clarify and update reviewed manual content to correspond to
         modifications and field conditions.
   B. Format: Submit operations and maintenance manuals in the following format:
      1. Two (2) paper copies. Include a complete operation and maintenance directory. Enclose
         title pages and directories in clear plastic sleeves.
C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Design Professional will make comments, as necessary, or will forward manuals to the Owner.
   1. Correct or modify each manual to comply with Design Professional's comments. Submit copies of each corrected manual within 15 days of receipt of Design Professional's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY
   A. Organization: Include a section in the directory for each of the following:
      1. List of documents.
      2. List of systems.
      3. List of equipment.
      4. Table of contents.
   B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
   C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
   D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
   E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.02 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS
   A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
      1. Title page.
      2. Table of contents.
   B. Title Page: Include the following information:
      1. Subject matter included in manual.
      2. Name and address of Project.
      3. Name and address of Owner.
      4. Date of submittal.
      5. Name and contact information for Contractor.
      6. Name and contact information for Design Professional.
      7. Names and contact information for major consultants to the Design Professional that designed the systems contained in the manuals.
      8. Cross-reference to related systems in other operation and maintenance manuals.
C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
   1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name and subject matter of contents. Indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
   5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations. Consider other special requirements, such as using photographs instead of drawings to demonstrate unusual installations.

F. **Operation Data Content:** Include operation data required in individual Specification Sections and the following information:
   2. Operating standards.
   3. Operating procedures.
   4. Operating logs.
   5. Wiring diagrams.
   6. Control diagrams.
   7. Piped system diagrams.
8. Precautions against improper use.
9. License requirements including inspection and renewal dates.

G. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

H. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

I. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

J. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

K. Product Maintenance Content: Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

L. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

M. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Reordering information for specially manufactured products.

N. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

O. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

P. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

Q. System and Equipment Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

R. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

S. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

T. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

U. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

V. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
W. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

X. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Product Maintenance: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.

E. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 20
SECTION 019000 - ADDITIONAL REQUIREMENTS FOR DIVISIONS 21-28

PART 1 - GENERAL

1.01 SUMMARY

A. Conditions and requirements included in this section and related subsections (019010, 019020 & 019030) are in addition to requirements in General Conditions of the Contract and other Sections of Division 1; and shall govern work of Division 21-28, where applicable, the same as if repeated in respective sections of the Project Manual.

1.02 DESCRIPTION OF LANGUAGE FORM AND SPECIFICATION FORMAT

A. These Specifications are written in imperative and abbreviated form. This imperative language of the technical sections is directed at the Contractor, unless specifically stated otherwise. Except where worded to the contrary, fulfill (perform) all indicated requirements whether stated imperatively or otherwise.

1. Specifications are written in outline format, utilizing abbreviated language form to reduce bulk. Repetitive words and phrases not contributing to clarity ("the", etc.) are deleted in most instances.

2. In most cases where a colon (:) is used within sentences or phrases, the words "shall" or "shall be" shall be supplied by inference.

3. Singular or plural nouns used to describe materials do not necessarily indicate quantity. Quantities shall be as shown or required.

4. Underscoring of paragraph subjects is utilized to aid the reader in locating key words and no particular significance shall be attached to underlined words.

B. Specifications are arranged in Divisions and Sections, based in general upon the Construction specifications Institute forty-eight - division format.

1. Division and Section titles are not intended to imply a particular meaning or to fully describe the work of the respective Division or Section.

2. Sections are arranged in numeric sequence; however, not all successive numbers are utilized and the contents listings must be consulted to determine the section numbers used in the Project Manual.

3. Alpha-numeric designations have been assigned to paragraphs to aid in quickly locating and referencing paragraphs.

1.03 DEFINITIONS

A. "By Owner" used in specifications or on drawings refers to items furnished by the Owner directly or through a separate contract.

B. Words and abbreviations such as: "Mechanical", "Plumbing", "Heating", "Insulation", "Electrical", "Communications", "E.C.", "G.C.", "H.C.", "M.C.", "P.C.", etc. used in Project Manual or on drawings are used in their generic sense to identify generic types of work and these words are not intended to imply a reference to contractor and subcontractor titles or names of trades which may incorporate the same words. Use of such words shall not be construed as an attempt to assign work or materials to a particular trade or contract.
C. The word "approved", if used in relation to action by Architect/Engineer, shall be understood to mean that the subject "approved" item has been adjudged by Architect/Engineer to be of acceptable quality and in conformance with general design concept. The terms "approved" and "acceptable" do not mean, and shall not be assumed to imply, that the subject item is of proper composition, dimension or quantity or that it is fit for the conditions of the work; verification and coordination of such details shall be the responsibility of the respective Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 019000
SECTION 019010 - REQUIREMENTS IN GENERAL FOR DIVISIONS 21-28

PART 1 - GENERAL

1.01 SUMMARY
   A. This section is a subsection of Section 019000 and includes additional requirements in general, which apply to Division 21-28.

1.02 DEFINITIONS
   A. "Contractor" used in this section refers to the contractor responsible for respective Division 21-28 Work.

1.03 COOPERATION AND COORDINATION WITH THE OWNER
   A. Cooperate fully with Owner and his authorized representative(s), at all stages of the work, to the end that no serious inconvenience or hazard may be present affecting access, use, or safety of the premises.
   B. If Owner takes beneficial occupancy of the building or portions of the building prior to completion of the project, maintain close coordination on all respective Work affecting occupied spaces. Designated responsible supervisory personnel in respective area must be advised sufficiently in advance of all Work affecting respective area so that normal operations will not be unduly disturbed. Schedule all respective operations so as to cause minimum interruption of or interference with normal use of occupied spaces.

1.04 DRAWINGS AND SPECIFICATIONS
   A. Drawings and Specifications are complementary and are intended to be used together to produce a complete finished project.
   B. Drawings are essentially diagrammatic and do not necessarily show all system components, accessories, etc., nor exact location of equipment, although size and location of equipment is drawn to scale whenever possible. Specified components and accessories shall be provided and installed, whether indicated or not.
      1. Acceptable equivalent products may have dimensions, and rough-in and connection requirements that differ from product representations shown on drawings. Coordinate space, location, rough in, and connection requirements of products furnished with actual conditions where respective product is to be installed.
      2. Drawings indicate required sizes and points of termination of conduits, piping, ducts, etc., and suggest proper routing, but it is not the intention of drawings to indicate all necessary offsets. Install work in a manner to conform to structure, avoid obstruction, allow access, preserve headroom and keep openings and passageways clear, without further instructions or cost.
      3. It is intended that apparatus shall be located symmetrically with Architectural elements unless indicated otherwise and coordinated with all other Work, although locations indicated on drawings may be distorted for clearness in presentation.
      4. Locations of switches, thermostats, outlets, equipment, etc. shall be governed by locations of adjacent openings, swings of doors and other construction details, wall mounted items, equipment, cabinetwork, etc. Most recent issue of construction drawings and shop drawings of respective items shall be consulted for coordination.
5. Where present general construction, present services, present mechanical and electrical installations and other present work are shown on drawings, such drawings have been prepared from drawings for present building(s) of work. General Conditions govern relationship of work to existing conditions.

6. Equipment rough-in and connections (size, locations, arrangement, etc.) shown on drawings are typical and, as such, they are subject to variations as determined by specific manufacturer's details. Contractor shall not run any conduit, ductwork, etc. on the surface, exposed, unless indicated on drawings, or approved by Owner.

C. Specifications furnish information that either cannot be pictorially presented or is not indicated on drawings. Specifications or Contents listings are not intended as material lists for the work. All materials and manufactured items shown on drawings may not necessarily be mentioned in specifications.

1. Specifications describe the general design and operation of specific items and they may not mention all the accessories and apparatus necessary for a complete functional item, however, it is intended and shall be understood that all items shall be complete with all necessary associated items required to function as intended. All items shown on drawings must be furnished, whether included in specifications or not. Any items on drawings or supplied by Contractor that are not included in the specifications shall be approved by the Owner and Architect/Engineer.

2. The specified requirement is the minimum to be provided or performed. Actual work shall comply with specified minimum or may exceed the minimum within reasonable limits.

D. Fixtures shown on Drawings are intended to be piped/wired complete with final connections. Include all material and labor required to provide all utility services and final connections (whether shown or not) to assure that all plumbing and light fixtures, etc. are fully functional.

1.05 MODIFICATIONS TO DRAWINGS AND SPECIFICATIONS BY CONTRACTOR

A. General Conditions govern modifications to drawings and specifications.

B. Descriptive data, shop drawings, etc. that are submitted to the Architect/Engineer for review do not constitute "modifications requested in writing" unless it is brought to the attention of the Architect/Engineer that specific changes are being suggested and requested.

C. In any event, all costs for changes required to accommodate changes to the drawings and specifications shall be the responsibility of the party initiating such changes.

1.06 INSTRUCTION IN OPERATION OF EQUIPMENT

A. After equipment has been placed in satisfactory operating condition, Contractor (or factory instructor if specified) shall instruct Owner's designated representative(s) in operation of all respective equipment.

B. Written Verification of Instruction: provided to Architect/Engineer by Contractor, signed by Owner or his representative, stating that Owner's representative understands the operation of respective equipment.

1.07 OPERATING AND MAINTENANCE MANUALS

A. Operating and Maintenance Manuals: prepared by each Contractor, each containing complete data for all respective equipment and systems provided by him, each bound in a separate "hard
cover" loose leaf binder bearing project name, date of installation, contractor's name and address, daytime and emergency telephone numbers on the front cover, complete with Table of Contents and corresponding Index tabs with all equipment clearly identified.

B. Manuals: incorporate complete printed data including the following:

1. One copy of each final ("accepted") submittal (with review comments), indicating all applicable and pertinent information marked at time of submitting data for review (ie: model numbers, options provided, finish and color, capacity and head ratings (with duty point), dimensional information, electrical characteristics, materials of construction, etc.). Manuals containing generic, unmarked cut sheets are not acceptable and will be returned for additional information to be added.
   a. See Section 211313 – Fire Protection for additional O&M Manual requirements to be provided on DVD, in PDF format. Additional DVD’s to be provided for engineers records

2. Operating Instructions: integrate each piece of equipment in any one system into a numbered step by step sequence of operation, with equipment identified by designations used on this project.

3. System and Equipment Wiring Diagrams: as installed, with equipment identified by designations used on this project.

4. Individual Sub-System Manuals: identified by designations used on this project.

5. Parts Lists: provided for each piece of equipment, consisting of a complete list of replacement items with all parts numbered and illustrated and complete directions for ordering replacement items. Lists shall include manufacturer's address and names of local sources for replacement parts. Standard interchangeable parts (i.e., belts, etc.) shall be listed with part numbers of various manufacturers cross-referenced.

6. Completed, signed and dated test forms: included for equipment and systems such as domestic and hydronic water piping systems, storm and sanitary piping systems, fuel gas piping systems, fire protection (underground and above ground) piping systems, backflow preventers, etc.

7. Factory start-up reports for mechanical equipment.

8. Maintenance Procedure: outline required routine maintenance and lubrication for all equipment and systems.

C. Review Copy of Manual: submitted for Architect/Engineer's review and comments, one (1) copy. After final manual format and contents have been determined, provide three (3) complete manuals.

D. See Section 211313 Fire Protection for additional / superseding requirements

1.08 RECORD AND AS-BUILT DRAWINGS

A. Maintain, clean and protected, a set of prints of Contract Drawings to be used as "Record Drawings". Record, on respective "Record Drawings", locations and nature of all Work installed other than as shown on original drawings, including all addendum items, change orders, shop drawings, etc.

B. Record Drawings (prints): used exclusively for this purpose, kept up-to-date at the jobsite, with progress of work and made available for review when requested.
C. Furnish to Architect-Engineer, immediately after completion of the project, a complete set of revised As-Built Record Drawings.

D. See Section 211313 Fire Protection for additional / superseding requirements.

PART 2 - PRODUCTS  (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 019010
SECTION 019020 - PRODUCT REQUIREMENTS IN GENERAL FOR DIVISIONS 21-28

PART 1 - GENERAL

1.01 SUMMARY

A. This section is a subsection of Section 019000 and includes additional product requirements in general which apply to Division 21-28.

1.02 DEFINITIONS

A. "Contractor" used in this section refers to the contractor responsible for respective Division 21-28 Work.

1.03 MATERIAL AND EQUIPMENT STANDARDS

A. All Equipment of a Particular Type and Related Accessories: the products of a single manufacturer or supplier to eliminate the necessity to maintain service parts inventory for products from multiple sources.

B. Provide appropriate products at terminations of all facilities (air terminals, fixtures, devices, appliances, trim [faucets], etc.); unless facilities are indicated to be "roughed-in only" or to be connected to an item furnished by others.

C. Motors: Provided with each motorized unit; appropriate and acceptable type, size, characteristics, etc.; complete with drives.

D. Products specified by proprietary item descriptions, model numbers, catalog numbers, manufacturer's trade name or similar reference, are only to establish general design. Such products shall be altered as and when required to provide all features called for or shown and to conform to all conditions affecting the work. Actual identification numbers denoting features and capacities specified or required shall be determined by contractor and supplier through comparison of respective manufacturer's specifications with project specifications and drawings (schedules, notes, details, etc.), job conditions and applicable codes and regulations.

1. Referenced items may not have the same rough-in and connection requirements and locations as those shown on the drawings. Equipment rough-in and connections are subject to manufacturer's standards for items furnished and piping, conduit, wiring, etc. shall be installed accordingly without added cost to the Owner.

2. Coordinate mounting, fit, trim, etc., of respective items furnished, with design and construction of adjoining equipment or construction. Take special care to coordinate flange and trim design with related construction.

1.04 STANDARDS OF PRODUCT ACCEPTABILITY – SUBSTITUTIONS

A. Requests for use of substitute products are governed by Instructions to Bidders.

B. Products proposed, as equivalent substitutes shall be considered NOT ACCEPTABLE unless, prior to bid date, Architect-Engineer has issued a letter of acceptability or the product has been listed as acceptable by addendum.

C. Substitute Products: governed by "Equipment Size, Capacity and Space Requirements" in this Section.
1.05 EQUIPMENT SIZE, CAPACITY AND SPACE REQUIREMENTS

A. Coordinate equipment with services, space available, other equipment, etc. and verify with manufacturer the compatibility and suitability of the product with the conditions in which it will be installed and operated. All mating parts and surfaces and service characteristics of equipment and materials shall be fully coordinated by contractor before items are released for shipment.

1. Special care shall be taken in coordinating substitute products with related work to assure that arrangement, rough-in, connections, alterations, additional work, etc. will be correct and complete.

B. Contract Documents determine general design of equipment and constitute minimum performance standards. Exact disposition of equipment is subject to manufacturer's design and methods, but space occupied, general design and equipment capacities and performance shall correspond to Contract Documents.

C. Equipment Size and construction: suitable for space available, allowing for proper access and clearance for maintenance, replacement, tube or coil removal, etc.

1.06 PRODUCT REVIEW DATA FORMAT

A. Data Submitted for Review: bound in brochures, provided with Tables of Contents listing all contents of the brochure.

1. All data for a particular type of equipment or system shall be included in same brochure (pumps, A/H equipment, unit ventilators, insulation, diffusers and grilles, drains, fixtures, panelboards, alarm systems, communication systems, etc.). Multiple copies of a particular data sheet stapled together will not be acceptable as required brochures. Brochures shall be composed of data for all items of a similar type bound in one cover. Incomplete brochures will be returned for correction.

2. Transmittal Letter: provided with all submittals, listing all included items and their respective section numbers.

3. Each Drawing, Catalog Sheet, Brochure, etc.: Labeled to indicate tag (or mark) number; Name of product; Contractor; Manufacturer; Brand; Job Number; Specification, page and item numbers, etc.

4. Product data shall be clearly and legibly marked in a manner that will permit photocopying if necessary (highlight markers are not acceptable). Examples of information required to be marked: Model numbers, Options, Style, Finishes (other than standard), Pump capacity and head, Electrical characteristics, Thermal and pressure gauge scales and stem info, Thermal well info, Materials of construction options, Pressure ratings (if multiple are indicated), Valve options, Etc.

   a. (Note to other Divisions) Gas information needed as part of the product data submitted from other Divisions (ie: Food Service Equipment, Standby Generators): Gas input/hour (MBH, or BTUH); Minimum and maximum operating gas pressure (“inches water column” (“w.c.”), or pounds per square inch (psi)).

5. Installing Contractor (and G.C., or C.M. when applicable) shall closely review, stamp and sign all submittals prior to submitting to Engineer for review. Submittals received without the installing Contractor’s “Approved” stamp and signature will be rejected, and returned without review.

B. Data for Systems: include complete wiring diagrams for this specific project and a list of equipment for the system.
PART 2 - PRODUCTS

2.01 ELECTRIC MOTOR STARTERS AND DRIVES

A. All electric motors and drives furnished for use on this project shall comply with requirements herein.

B. Motors and Drives: furnished by respective equipment manufacturer as a component of equipment supplied; of type design, and size appropriate for use intended. Separate motors or drives will not be accepted. All motors and drives for similar equipment shall be from the same manufacturer.

1. Motor Data for Each Motor: included with every equipment submittal for review. Data shall include the nameplate horsepower (KW input for hermetics), phase, voltage, Hz, speed, number of windings, full load amperes, locked rotor amperes, insulation temperature rating, manufacturer, frame numbers, RPM and NEMA classifications.

2. Promptly furnish, to Division 26 Contractor, certified shop drawings or equipment data, including motor data and control diagrams, for all respective motorized equipment furnished. Data shall include motor data, control diagrams, and all other information necessary for selecting required starting and control equipment and determining required power circuit rating.

3. Mount, align and adjust all motors and drives furnished as part of respective work.

C. Motors: conform to applicable provisions of NEMA standards; be squirrel cage induction design, except hermetic type motors; designated drip-proof unless indicated otherwise, with screen covered baffled air vents located in underside of end bells and frame. Fractional-horsepower fan motors shall be permanent split capacitor type. Frame shall be NEMA standard and conform to N.E.C. requirements. Starter magnet wire and insulations shall be suitable for 135°C total temperature with entire insulation system NEMA type "B" (based on 40°C ambient temperature). Epoxy insulation shall be provided in motors located outside or in damp environment. Motor bearings shall be ball or rolled type with sealed housing providing dust and dirt protection and equipped with grease fittings. Thrust bearings shall be provided in vertical motors.

1. Horsepower Requirements
   a. Horsepower listings in specifications or on drawings are nominal, for estimating purposes only, and subject to individual equipment manufacturer’s requirements.
   b. Fan Motor Nameplate Horsepower Rating: not be less than 20 percent above total of actual fan brake horsepower and drive loss at scheduled capacity for forward curved blade type fans; not less than 5% above for other types.
   c. Motor Size: as required to operate equipment at any capacity within equipment operating range, with motor horsepower rating not less than 10% above highest horsepower requirements within equipment operating range.
   d. Pump motors shall be non-overloading at all points along the pump curve.

2. Electrical Current Characteristics of Motors: verified from electrical drawings by equipment supplier and respective Contractor furnishing equipment who shall be responsible for correctness of same.

3. Motor Nameplate Voltage: same as electrical system design voltage, except nameplate voltage may be NEMA standard voltage if furnished with written guarantee by motor manufacturer, guaranteeing satisfactory operation and normal life when operated on system design voltage.
4. Built-in Thermal Protection: provided in all Motors 1 HP and below.

5. Rating for All Motors: for operation at plus or minus 10% of normal voltages of building service and distribution.

6. Service Factor: 1.15% minimum on all motors, except high starting torque applications shall have 1.25% service factor.

7. Single Speed Motors: 1750 RPM, unless specified or scheduled otherwise.

8. Motors Designed for Reduced Voltage Starting: provided, of type designated, for particular application. In general, reduced voltage starting will be required for motors 20 hp and larger on 208-240 volts and 40 hp and larger on 480 volts, verify requirements with respective equipment specification.

9. Motors and starters shall be built for the horsepower, 60 cycle of the voltage as specified or scheduled on the Electrical Drawings.

10. Acceptable motors are Century, Marathon, Gould Delco, Westinghouse and G.E.

D. Starters: Acceptable motor starters shall be Allen Bradley, Square "D" or Westinghouse.

1. Equipment with motors. Every item of motor-driven equipment shall be furnished complete with starters.

E. V-Belt Drives: provided for all equipment not direct connected to motor, unless another type drive is specified for a particular application; acceptable single or multiple belt design as required for load applied.

1. Sheaves: machined cast iron or machined cast steel with interchangeable bushings using tapered bore principal for aligning and securing bushing to shaft and sheave. Drive sheaves shall be adjustable for 15% variation above or below specified driven speed.

2. Belts: super service type, oil and heat resistant, static dissipating; in matched sets for multiple belt drives.

3. Belt Guards: provided for all drives, constructed of steel, approved sturdy design, with slotted openings for shaft access to permit shaft speed measurement without removing guard. Guard design shall conform to all applicable safety regulations, codes and standard and permit easy access to belts.

4. Drive Shafts: center drilled to receive cone type tachometers.

5. Alignment and Adjustment of Drives: performed by or under direct supervision of a qualified technician representing equipment or drive manufacturer.

2.02 FOUNDATIONS AND BASES FOR MECHANICAL AND ELECTRICAL EQUIPMENT

A. Concrete Foundations or Bases: provided by Contractor furnishing respective mechanical and electrical equipment, for following equipment unless excepted in individual equipment specifications or schedules:

1. Floor mounted equipment in equipment rooms, penthouses and unfinished areas.
2. Equipment on the ground outside.
3. Equipment specified or shown to have foundation or base.

B. Anchor Bolts: furnished and installed by respective Contractor, where anchor bolts are required.

C. Forming, placement and finishing of concrete shall be performed with first class workmanship,
with all exposed surfaces troweled or ground smooth and corners rounded.

D. Concrete: of a mix producing 3000 psi compressive strength after 28 day cure for interior usage and 4000 psi compressive strength after 28 day cure for exterior usage.

E. Reinforcement: provided in accordance with good design practice.

F. Foundations and Bases:
   1. Size and Shape: determined by respective contractor to conform to shape of equipment furnished. In general foundations and bases shall have a perimeter located 4" outside the respective equipment, unless indicated otherwise.
   2. Reinforcement: provided in each foundation and base; 4" x 4" mesh, No. 6 gauge wire or other reinforcing when and as detailed on drawings or called for in individual equipment specifications or manufacturer's recommendations.
   3. Height: 4" above finished floor unless indicated otherwise.
   4. Isolated Foundations: provided where called for by drawings or specifications, separate from floor slab, as detailed on drawings.
   5. All Foundations and Bases on Floors: bonded or doweled to floor slab as approved by Architect-Engineer.
   6. Locations: coordinated with other installation (equipment, drains, etc.).
   7. All Foundations and Bases Located Outside: of appropriate depth; provided with footings as required for stability.

G. Anchor Bolts and Inserts
   1. Furnish appropriate anchors or inserts for respective equipment, and set to template as foundations are formed.
   2. All Anchors: arranged to allow horizontal movement of bolts to facilitate alignment.
   3. Anchors for equipment other than close-coupled pumps may be L-bolts set in pipe sleeves to allow movement to facilitate alignment.
   4. Pumps: have anchor bolts arranged for installation from above into inserts in the foundation to allow motor to be removed from foundation without disturbing pump or piping.
      a. Anchor Inserts: consist of a threaded movable plate housed in a cost iron body provided with an L-bolt anchor or a threaded movable plate housed in a recessed housing provided with a sleeve riser for anchor bolt; equivalent to Decatur Engineering Company "standard" or "heavy duty" type as required.
   5. Threaded Parts: protected from damage and rust.

2.03 ROOF CURBS AND SUPPORTS FOR MECHANICAL AND ELECTRICAL EQUIPMENT

A. Furnish all roof curbs, supports, etc., required to support respective equipment or enclose roof openings for respective work.
   1. Roof Curbs: provided for Power Ventilators and for ducts, pipe, conduits, etc., passing through roof.
   2. Installation of curbs, supports, roofing and flashing will be performed as part of general construction work.
3. Installation of equipment, piping, etc., and counter flashing shall be the responsibility of the Contractor providing the respective Work.

B. Acceptable Manufacturers: Pate, ThyCurb.

C. Curbs and Supports: conform to the following requirements:

1. Size, Configuration and Location: determined by actual equipment furnished and verified before fabrication of curbs (supports) or construction of openings.

2. Configuration and Arrangement: sloped roof type; as required to suit roof deck construction; coordinated with respective general construction contractor; one of the following for respective construction, or as required by other construction:
   a. Uninsulated Steel Type Deck - designed to rest on deck with built-in cant strip.
   b. Insulated steel type Deck - designed to rest on deck with built-in cant strip starting at top of roof insulation.

3. Top Surface of Curbs and Supports: designed and installed to be level. Curbs and supports installed on sloped roofs shall be designed with bottom plane of curb or support built at same angle as slope of roof to provide level top surface when installed.

4. Curbs for Air Intake Equipment: designed to provide 18" minimum height above roof to bottom of intake opening.

5. Furnish all dimensions and information needed by other contractors for coordination.

6. All Work on Roof (Equipment, Etc.): secured to supports (curbs, etc.) in acceptable manner.

D. Curbs: sloped roof type, prefabricated galvanized steel (18 gauge minimum), equipped with wood nailing strip provided on top for securing equipment and built-in cant strip when applicable. Architect-Engineer shall adjudge design acceptable prior to fabrication.

1. Curbs for Openings: internally insulated, full height with 1" fire retardant foam plastic or 1-1/2" glass fiber insulation.

E. Pipe Entry Curbs and Caps: a complete coordinated assembly furnished by one manufacturer, unless otherwise indicated for larger pipe sizes.

1. Curbs: as specified in this section

2. Pipe (conduit) Entry Cap: consist of an acrylic coated ABS rib reinforced plastic curb cover with collar opening fitted with an ozone and ultraviolet resistant compression molded rubber cap having stepped nipple(s) for pipe seal. Number and size of nipples shall be as required for pipes (conduits) accommodated.

3. Stainless Steel Clamps: provided to secure nipples to pipes.

F. Installation of Curbs and Supports

1. Curbs, supports and flashing will be installed as part of roof construction work performed as part of General Construction work. Contractors providing respective Work shall install counter flashing curb covers, slide channels, supported work, etc. and secure Work to curbs and supports.

2. Counter Flashing: form a water tight cap over curbs and rails. Duct counter flashing shall be soldered to duct or otherwise sealed in an acceptable manner.
3. Pipe Entry Cap Nipples: secured water tight to pipe and conduit by stainless steel clamps. Unused nipples shall be provided with water proof plugs secured by stainless steel clamps.

2.04 VIBRATION ISOLATION AND NOISE CONTROL FOR MECHANICAL AND ELECTRICAL EQUIPMENT

A. Isolate all Mechanical and Electrical equipment from building structure by means of noise and vibration isolators to prevent transmission of vibration and mechanically transmitted sound to building structure, unless equipment is free from vibration or hum.

1. Provide isolating connections between ductwork and motorized equipment, between piping and motorized equipment (pumps, etc.) and between motors and conduit systems to prevent transmission of vibration and mechanically transmitted sound to duct, pipe and conduit systems and building structure.

2. Pumps mounted on concrete foundations or bases located on concrete floors ON GRADE are required to be mounted on isolators.

B. Support, align and isolate respective equipment and piping in a manner that will allow all pipe and equipment movement without transmitting vibration noise to building construction.

C. All Vibration Isolation Materials: provided, for respective Division of work, by a single manufacturer to assure single responsibility for the proper performance of all isolation materials used.


D. Vibration Isolator Selection: in accordance with weight distribution so as to produce reasonable uniform deflection. Deflections shall be as recommended by isolator manufacturer and loads shall not exceed published load capacity of isolators.

E. Descriptive Data: submitted for acceptability review; complete with performance information for all vibration and noise control products; referenced to related equipment.

F. All Equipment Mounted on Vibration Isolators: have minimum operating clearances of 1" between bases and floor beneath.

G. Submit a report to Architect-Engineer substantiating that all respective equipment and piping has been adequately isolated and that acceptable noise levels exist in occupied areas.

H. Flexible Connections: provided as follows:

1. Fan and Air Handler Air Inlets and Outlets: connected to ductwork with a flexible connection as specified with sheet metal.

2. Piping Connected to Equipment on Isolators: connected with a flexible connection.

3. Conduit Connected to Motors and Equipment on Isolators: connected with flexible conduit as specified.

I. Equipment Support Isolators: one of the following, whichever is applicable.

1. Equipment Suspended From Structure: suspended on steel spring and elastomer hanger isolators. Hanger design shall be such that misalignment will not occur and short circuit isolation when proper installation is made. If unit does not contain a frame with mounting
brackets of suitable rigidity and strength, or has an extreme overhanging condition, structural steel members acceptable to Architect-Engineer shall be supplied and installed, by Contractor furnishing equipment, to support suspended unit.

2. Equipment Mounted on or Supported From Floor: supported by one of the following as shown on drawing or recommended by isolator manufacturer: (Supporting framework shall be supplied and installed by respective Contractor.)

   a. Spring Isolators: laterally unrestrained, free standing, unhoused, stable coil spring mounts with built-in leveling bolts and base plate having a 1/4" elastomer sound pad on bottom surface, used for all loads over 200 pounds unless indicated otherwise.

   b. Neoprene-In-Shear Isolators: incorporate a cast-in tapped steel load plate in a 2500 psi tensile strength, oil resistant, molded neoprene pad with a cast-in drilled steel anchor/base plate, used for all loads of 200 pounds or less unless indicated otherwise.

   c. Pad Type Isolators: elastomer, molded with grooved or waffle faces.

J. Isolator Installation

   1. Install and align respective equipment before vibration control apparatus is installed. Equipment shall be in alignment after isolators are installed and shall remain in alignment while equipment is in operation.

   2. Bolt isolators to respective equipment and supports (curb, etc.). Equipment with built-in isolation shall be bolted to supports. Bolting of vibration isolators to floor is not required for indoor installations, unless indicated otherwise.

      a. Isolators with elastomer pads on bearing surfaces, which are bolted to supports, floor or foundation, shall be equipped with elastomer washer with metal back-up washer installed on top of isolator flange, under each bolt head and/or nut.

   3. Equipment having torque or thrust forces which cause short circuiting of isolation due to misalignment shall be provided with isolated restraints to maintain equipment alignment.

2.05 ACCESS DOORS / PANELS FOR MECHANICAL AND ELECTRICAL INSTALLATIONS

A. Furnish access doors / panels for access to respective mechanical and electrical work (valves, air vents, terminal boxes, equipment, etc.) installed in all locations not accessible through panels furnished in general construction. Required locations include, but are not limited to, pipe spaces where access panels are not part of general construction, and in walls and ceilings except "lay-in" type. "Accessibility of Work" in Section 019030 governs accessibility.

B. Installation of access doors / panels: performed by respective general construction trade. Costs for panels and installation shall be paid by contractor furnishing respective Work requiring access.

C. Locations for access doors / panels: acceptable to Architect-Engineer; determined by Contractor for proper access to respective Work.

   1. Wherever possible, without additional piping, conduit, etc., items which required access shall be installed in acceptable locations that will not required access panels.

D. Design and trim of all doors / panels: acceptable to Architect-Engineer.

   1. Acceptable Manufacturers: Bilco, Milcor, Elmdor Stoneman, MiFab.

E. Door / Panel Size: as shown on drawings or required; minimum 12" x 18"; match even tile modules when located in tiled walls.
F. Door / Panel Construction: incorporate following features:
   1. 16-gauge steel trim flange 1" wide or plaster stop as required to finish to general construction materials.
   2. Finish: factory applied baked enamel prime coat over a protective phosphate coating on the steel.
   3. Masonry Anchors: factory attached to frame assemblies on units that are to be installed in masonry.
   4. In "Fire Rated" Construction: have frame and panel assembly manufactured under factory inspection service of Underwriters' Laboratories, Inc. and shall bear U.L. label for use intended; 16-gauge steel frame; 20-gauge steel, sandwich type panels; cylinder type, self-latching lock assembly, with key operated cylinder lock and mechanism to release latch from inside; continuous hinges of galvanized steel with stainless steel pin.
   5. In Construction Not "Fire Rated": have frame design with trim suitable for type of construction where used; 16-gauge steel frame; 14-gauge steel panel; flush, screwdriver operated lock with metal cam; concealed hinges spring type, opening to 175°.
   6. Access doors at pipe chases shall be hinged, with cylinder type self-latching lock assembly, with key operated cylinder lock.

2.06 PAINTING OF MECHANICAL AND ELECTRICAL WORK

A. All materials and equipment furnished as part of the Work of Division 21-28 shall have an acceptable factory finish, unless prime coat is specified for an individual item of material or equipment. All colors shall be as selected by Architect-Engineer.

B. Field painting is governed by Painting Section and will be performed as work under this contract.
   1. Paint all respective exterior work that does not have acceptable factory finish.
   2. Protect factory finishes and prime coats and refinish respective equipment that has damaged factory finish.
   3. All visible surfaces of sheet metal behind grilles and registers shall be painted flat black as a part of Sheet metal Work.
   4. Painting near/adjacent to automatic sprinkler heads shall be coordinated closely with sprinkler contractor. Work shall not commence until sprinkler contractor has properly covered all sprinkler heads in the area. Heads shall not be subjected to paint or overspray.

C. Identification Plates (motor and equipment name and data plates) shall not be painted.

D. Painting Materials: best grade of each representative type.
   2. Primer or Undercoat: formulated for use with finish used and for use on material to which applied.
   3. Where finished work will be exposed to moisture, finish and surface preparation materials shall be specifically formulated for such application.

E. Factory Applied Baked Primer: provided on equipment to be field painted.

F. Remove all rust, scale, dirt, loose paint, grease, etc. from the surfaces of respective work as preparation for painting.
G. Insulation to be Painted: have smooth paintable surface. Insulation surfaces that are not smooth or are not paintable shall have a sized glass fiber cloth covering provided by insulation installer, over entire surface to be painted including joints and fittings.

H. Factory Finishes: touched-up with matching paint or refinished in a manner acceptable to Architect-Engineer. Badly damaged or otherwise unsuitable factory finishes shall be totally repainted.

I. Field Finishes: applied in two coats of color over primer or undercoat. Primer shall be field applied to all items to be field painted which do not have acceptable factory primer.

J. All Work: left with a neat and unblemished finish, acceptable to Architect-Engineer.

2.07 MECHANICAL AND ELECTRICAL EQUIPMENT AND SYSTEM IDENTIFICATION

A. Provide identification for respective work as specified herein and in respective sections, including but not necessarily limited to:

1. Valve Tagging.
2. Pipe and Conduit Labeling.
3. Signage permanently affixed at “non-potable” outlet locations.

B. Tagging: permanently secured to valve with link chain.

1. Valve tags shall be 1" diameter brass or aluminum with indented numerals painted black.

2. Contractor shall furnish and install a complete valve tag chart containing all valve tag numbers and indicating valve location and function (including backflow preventers). Chart shall be contained within a glass enclosed black wood frame and hung in building where directed by Architect-Engineer.

C. Labels: provided on all exposed Piping and Conduit in equipment rooms (boiler rooms), electric rooms, penthouses, accessible pipe spaces (chases, ceilings, tunnels, etc.), except temperature control air piping and lighting circuits do not require labels.

1. Insulation and/or paint (when required) shall be applied and cured before application of labels.

2. All Piping: clean and free of dust, water, oil, etc. when labels are applied.

3. Labels: one of the following (only one type of label shall be used throughout the project).

   a. Stencil Painted: have wording painted light gray on dark background and black on light background, using machine cut stencils.


      1.) Reference Product(s): Emed Co. Inc. "PERMark", Seton Name Plate Corporation "Set Mark".

4. Wording: indicate contents and flow (arrow) for piping; and circuit number, voltage, phase and type (Emergency, Fire Alarm, Telephone, Exit Light, etc.) circuit for conduit.

5. Apply labels every fifteen (15) feet along pipe or conduit and at least one label on every respective pipe less than fifteen feet long. No exposed or accessible portion of respective pipe shall be without a label in designated spaces.
a. On projects where “Potable” and “Non-Potable” water piping systems occur, both shall be clearly identified by labeling each as follows (in addition to required the system and direction of flow labeling described above) and shall be per the current Indiana Plumbing Code:

1.) Potable: Green background with white lettering.
2.) Non-Potable: Yellow background with black lettering, with the words “Caution – Non-Potable Water: Do Not Drink”.
3.) Minimum size of letter and length of color field shall comply with the current edition of the Indiana Plumbing Code.

D. Signage: Provided on projects where “Non-Potable” water piping systems occur, an OSHA compliant “Caution” sign and shall be permanently affixed to an acceptable mounting surface, at each outlet or spigot location. Signage shall be permanently mounted, using an acceptable method as defined by the engineer at no additional charge. Contact engineer for directions, if mounting surfaces and methods are not defined on the drawings. Contractor shall include in his bid, the most restrictive installation parameters for each of the condition/location, based on the following parameters).

1. Signs: 10” wide x 7” high; constructed of one of the following materials (with overlayment) for each of the following conditions:
   a. Signs: Have yellow background, with black letters, reading “Caution – Non-Potable Water: Do Not Drink”.
   b. At solid, smooth mounting surfaces (when defined on the drawings as acceptable): vinyl sign with overlayment.
   c. At solid but textured wall surfaces (when defined on the drawings as acceptable): Solid plastic, or aluminum sign with overlayment.
   d. When no “acceptable” mounting surface is readily available:
      1.) At piping/outlet drops from above: Provide a corrosion resistant steel strut assembly with a 10” x 7” x 1/8” corrosion resistant mounting plate and an anchor plate solidly anchored to floor slab (or to a poured in-place 12” x 12” x 18” deep minimum concrete base, when located in bituminous paving, grass areas, etc.), or secure to pipe. Sign shall be solid plastic or aluminum with overlayment, and shall be located within 18” of the outlet or spigot (clearly intended for the outlet).
      2.) At a pipe/outlet stub-up from below: Provide a small corrosion resistant concrete 14” x 12” x 18” deep concrete monument (top recessed the depth of sign and flush to grade, or surrounding surfaces). Sign shall be recessed into the top of the monument base (flush with floor slab, sidewalk, paving, etc.). Sign shall be of aluminum construction with overlay, and located at the outlet or spigot.

PART 3 - EXECUTION (Not Used)

(Respective installation specifications are included in respective product specifications in this Section.)

END OF SECTION 019020
SECTION 019030 - EXECUTION REQUIREMENTS IN GENERAL FOR DIVISIONS 21-28

PART 1 - GENERAL

1.01 SUMMARY
   A. This section is a subsection of Section 019000 and includes additional execution requirements in general which apply to Division 21-28.

1.02 DEFINITIONS
   A. "Contractor" used in this section refers to the contractor responsible for respective Division 21-28 Work.
   B. “Contractor’s Financial Responsibility for Work Directly Related to His Own”: Contractor is responsible for hiring experienced contractor(s) to perform tasks directly related to his portion of the project, when he is not qualified to do so. Contractor is not qualified to perform tasks which he does not perform on a regular basis.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 CONTRACTOR’S FINANCIAL RESPONSIBILITY FOR WORK DIRECTLY RELATED TO HIS OWN.
   A. Contractor’s Financial Responsibility for Work Directly Related to His Own: Contractor shall be financially responsible for assuring that work directly related to his portion of the project is completed by the appropriate trades by hiring experienced contractor(s) to perform the required tasks (i.e. landscaping contractor, finish carpenter, etc.). Contractor shall secure the services of appropriate (experienced) contractor(s) to perform such work, at no additional cost.

3.02 INTERFACE OF MECHANICAL AND ELECTRICAL WORK WITH OTHER WORK
   A. "Interface" is the point where work of a Contractor joins or connects to work of other contractors for the project, or to existing work, or to work by the Owner (provided directly or through other contracts).
   B. It is the intent of this item to describe in general the interface between work of the various Divisions.
      1. Detailed descriptions of interface items included in specifications or on drawings for an individual piece of equipment or system have precedence over the general descriptions herein.
   C. Conditions Governing Interface
      1. Drawings and specifications for all Divisions of work shall be considered to be cooperative to the extent that they are intended to be used together to produce a complete coordinated project including all equipment, materials, appurtenances, controls, labor, etc. and complete installation and connection necessary for the full, safe, functional use of the premises in the manner intended.
      2. Examine drawings and specifications and shop drawings or samples for all Divisions of the work and provide all materials and labor required to make Work complete where interfaced
with all other work. All respective rough-in and connections shall be provided to all items of equipment.

3. Since specifications provide for competitive bidding, descriptions in Contract Documents (Drawings and Specifications) are necessarily subject to variations consisting of individual manufacturer's standards and methods which comply with the intent of the drawings and specifications, but which differ in detail from the product or material described by Drawings or Specifications. The Contractor shall take these variations into consideration when determining what items will be required with his Work to coordinate it with other work.

D. Interface Responsibilities of Contractors

1. Each Contractor: responsible for all resulting additional costs, to himself, the Owner or to other contractors, which are related to installation of or connections for equipment or materials furnished by him when such equipment or material has variations from Work shown or specified. "Equipment Size, Capacity and Space Requirements" (Section 019020) and "Coordination of the Work" in this Section govern such work.

E. Responsibility for Interface Materials and Accessories

1. Interface items for work shown on drawings shall be the responsibility of the Contractor providing work shown on respective drawing, unless individually noted on the drawing to be by another Contractor or party.

2. If a particular item is indicated to be by one Contractor in one reference and is inadvertently indicated to be by another Contractor in another reference, each referenced contractor shall consider such item as being required as a part of his contract and Architect/Engineer will determine which referenced contractor will be allowed to furnish such work, while the other referenced contractor will be required to give the Owner a credit for not furnishing such item.

F. Equipment and Materials in General

1. Furnish all hardware, fittings, accessories, etc. required to join and/or secure respective Work to adjacent work or construction.

2. Recessed or Semi-recessed Items: complete with acceptable trim designed specifically for use with adjacent construction materials and methods.

G. Motor Starters (Running protection and control of operation).

1. Magnetic Starters: furnished complete with auxiliary contacts, fused control circuit transformer, push buttons, pilot lights, selector switches, control stations, etc., as required for the respective control sequence.

2. Division 21, 22 & 23 Work: include starters specified or shown with individual equipment or items, and providing all information necessary to determine required characteristics of respective starters.

H. All Required Disconnect Switches: furnished as part of Division 26 Work, except where required disconnects are furnished as part of a control package included with a system or an item of equipment.

I. Automatic Controls

1. Automatic Electrical Controllers (Float Switches, Pressure Switches, Etc.): furnished with equipment to be controlled unless specified or shown on drawings to be part of the work of another Contractor.

2. Automatic Temperature Controls (Thermostats, Damper Motors, Motorized Valves, Etc.): furnished as part of T.C.C. Work or supplied with respective equipment, as specified for respective equipment.
J. Manual Controls
   1. Manual Controllers (Switches, Pushbuttons, Pilot Lights, Etc.): furnished as part of Division 26 Work, unless included with a control package furnished with a particular system or item of equipment, as specified with respective equipment.

K. Installation of Equipment Services (Piping, Ductwork and Electrical)
   1. Detailed descriptions of interface items for an individual piece of equipment or system have precedence over the general descriptions herein when detailed descriptions are included in specifications or on drawings.
   2. Division 21, 22 & 23 Work: include the following:
      All Piped Services: run and connected to connection point of equipment complete with a valve and acceptable easily separable joint (union, bolted flange, etc.) shock absorbers and vacuum breakers where required. The only exceptions to this are where "rough-in only" is indicated, in which case a valve and capped threaded or flanged connection point shall be provided.
      a. Piping shall be concealed within walls/chases, casework, above ceilings and inside architectural bulkheads where indicated on the drawings, unless noted otherwise.
      b. Coordinate rough-in and final connections of all plumbing services with casework, sinks, and equipment being provided by the Owner (or by another trade), prior to executing work.
      c. All Ductwork Connections of Equipment: run and connected to connection point of equipment. Provide flexible duct connection for motorized equipment and other equipment that vibrates during operation.
      d. Solid Connected Drains: run and connected to tailpiece of equipment complete with an acceptable trap per specifications and in compliance with applicable codes. Terminate indirect waste at waste receptor using an air gap or air break as required.
   3. Division 26 Work: include the following:
      a. Electrical Feeders: run from source (through disconnect where required) and connected to power terminals of equipment (terminal block, pigtail or motor terminals as governed by individual equipment arrangement). Power feeder wiring shall be complete from circuit protection in panelboard to motor on terminal block, run through P.E. switches and other line voltage controls when included in motor circuit. Required junction boxes and flexible conduits shall be provided as a part of this Work.
      b. Coordinate and provide acceptable appropriate matching receptacles for all equipment that is furnished equipped with cord sets.
      c. Provide approved cord sets and matching receptacles for all equipment that is not solidly connected and is not furnished equipped with a cord set.
      d. Provide rough-in and connection items specified.

L. Installation of Motor Starters, Disconnects and Control Devices
   1. Division 21, 22 & 23 Work: include the following:
      a. Automatic Controls: installed complete as part of T.C.C. Work, including control wiring conduit run to related starter, etc.
   2. Division 26 Work: include installation of the following:
      a. All Starters, except starters that are part of a factory installed control package.
b. All Disconnect Switches, except where appropriate switches are provided as part of a factory installed control package.
c. All Electrical Control Panels not factory mounted on equipment, except T.C.C. control panels will be mounted as part of T.C.C. Work.
d. Control Stations (pushbuttons, pilot lights, etc.), complete with conduit run to related starter, etc.

M. Installation of Control Wiring

1. Control Wiring for Mechanical Equipment
   a. Control Wiring Between Starters and Manual Control Stations
      1.) Furnished and installed as part of Division 16 Work when control circuit does not include automatic controls or is not interlocked with other equipment.
      2.) Furnished and installed as part of T.C.C. Work when automatic controls or interlocking between equipment are included in control circuit.
   b. Control Wiring Between Starters and Automatic Controls or Other Starters: furnished and installed as part of T.C.C. Work.
   c. Wiring for Line Voltage Controls: furnished and installed as part of Division 26 Work from panelboard through starter and controls to motor or equipment terminals.

2. Control Wiring for Equipment Other Than Mechanical Equipment: furnished and installed as part of Division 26 Work.

3.03 ACCESSIBILITY OF MECHANICAL AND ELECTRICAL WORK

A. Special Attention: given, before installation, to the accessibility, which will be available to all parts of the apparatus when in the installed position.

B. Where possible without additional piping, ductwork, conduit, etc., items requiring access shall be located in acceptable accessible locations that will not required access panels other than panels provided with general construction.

   1. Where access panels are required for respective Work not accessible through panels provided with general construction, contractor shall be responsible for required access panels as specified in Section 019020.

C. All Adjustable Parts: placed within sight and reach of operating and maintenance personnel.

D. Ample Space: allowed for operation and removal of all parts that are subject to adjustment, replacement or repair.

E. All Lubrication Fittings: extended to an accessible location.

F. Coordinate locations for all required access panels (doors) necessary for proper access to respective concealed work, which requires operation, maintenance or adjustment. Access panels are required for all respective concealed installations, except work above "lay-in" tile ceilings.

3.04 COORDINATION OF THE MECHANICAL AND ELECTRICAL WORK

A. Installation Locations: governed by "Drawings and Specifications" (Section 019010), and "Accessibility of Work" and "Equipment rough-in and Connections" in this Section.

B. Minor changes in location of equipment, fixtures, etc. from locations shown on drawings shall be made without extra charge; to allow for proper access, to coordinate with other work, or if so directed by Architect/Engineer prior to installation.
3.05 INSTALLATION OF MECHANICAL AND ELECTRICAL WORK IN GENERAL

A. All Hardware and Accessory Fittings: of an approved type, designed, intended and appropriate for the use and complement items with which they are used.

B. Corrosion Protection: Provided for all materials, equipment, hangers supports, fastenings, accessory fittings, etc.; suitable for the atmosphere in which they are installed, whether located indoors or outside; appropriate for the application (electroplated, anodized, primed and painted, etc.).

1. Take care during installation to assure the integrity of corrosion protection. Damaged finishes shall be repaired in an acceptable manner or respective item shall be replaced with new.

C. Standard Threads and Heads: provided on all screws, bolts, nuts, clamps, fittings, fastening devices, etc., so they may be installed, removed and replaced when necessary without special tools, unless tamperproof hardware is specified.

1. Where tamperproof or special fasteners are provided, furnish to Owner three (3) matching tools (drivers, wrenches, etc.).

D. All Openings Designed to Accommodate Fasteners: equipped with appropriate fastener installed by Contractor, unless contractor provides in writing a statement from the product manufacturer stating that fasteners are not required for a particular application.

E. Damaged Fasteners: not be installed with work. Slots, heads, threads, contact surfaces, finish, etc. of all fasteners shall be free from tool damage or other defects. All damaged fasteners shall be replaced with new fasteners in good condition. Defective mating components shall be replaced or repaired in an acceptable manner.

F. Installation of Valves

1. Do not use wrenches with teeth in the jaws on any valve surfaces where parallel flat faces are provided for a smooth jaw wrench, nor on any part of valve not designed as a wrench surface.

2. Valves which show evidence of use of toothed wrench shall be replaced without cost as directed by Architect/Engineer.

3.06 MECHANICAL AND ELECTRICAL ROUGH-IN AND CONNECTIONS FOR EQUIPMENT

A. Rough-in: include all facilities required to isolate equipment from service (valves, stops, dampers, disconnects, receptacles, etc.) and all devices (vacuum breaker, backflow preventer, etc.) required by applicable codes, etc.

B. Connections: include all items required to interface respective equipment or fixture with respective services (traps, unions, supplies, flexible conduits, junction boxes, etc.).

C. Rough-in and Connection items shown on drawings are for estimating purposes only and actual work and materials required will be determined by actual equipment and fixtures furnished. Verify all requirements (size, capacity, rating, arrangement, etc.) prior to rough-in. Rough-in, piping, wiring etc. and installation shall be made according to the equipment manufacturer's instructions and wiring diagrams.

1. No claim or extra charge will be accepted for any variation from data shown on drawings or descriptions in specifications.

3.07 MECHANICAL AND ELECTRICAL WORK EXCAVATION AND BACKFILL

A. Perform all necessary excavating, including rock removal (if any), to install respective
underground Work; provide all necessary sheathing, planking, pumping, cribbing, barricades, flares, flashers, etc.; furnish and install all necessary bedding and backfill materials for Work; remove excess dirt, bedding and fill materials from premises; refill all settlement up to finished grade.

B. All Operations: conform to all applicable safety codes and regulations. All required safety equipment shall be provided as part of respective Work operations.

C. All surfaces, structures and installations (walks, drives, paving, lawns, shrubbery, etc.) affected by excavation shall be restored to their original condition, acceptable to Architect/Engineer.

D. No bedding or fill material shall be placed, spread or rolled while it is frozen or thawing or during unfavorable weather conditions.

E. No rocks will be permitted in the 12” immediately below finished grade.

F. All Bedding and Backfill Materials: inorganic, clean and free from vegetable matter, rubble, ashes, rock or other foreign matter. Cinders or ashes will not be permitted in bedding or backfill.
   1. Bedding Material: Compacted sand.
   2. Backfill Material: Sand (or engineered fill) shall be compacted in 6” lifts to at least 24” above centerline of pipe and in 10” lifts on up to slab (or grade) when located below buildings, drives, walks, parking areas and structures. Excavated earth from the project site which is free of silt and capable of proper compaction may be used for backfill where sand or engineered fill is not required. All portions and methods of backfill shall be compacted to 95% modified proctor.

G. Before proceeding with excavating, verify with the Owner, other contractors and available record drawings the locations of existing and new underground installations that may interfere with or be affected by respective Work. Locate respective Work so that it will not obstruct the path of other work. Contractor shall lay out his own work, taking field measurements from established bench marks and reference elevations.

H. Trenches: excavated of sufficient width to allow working space; bottoms shall be dug no deeper than is necessary for proper grading of various pipes and conduits. Contractor shall fill all excavations made deeper than required, with Ag lime #53 or engineered fill to proper level or grade. Excavating work shall not disturb existing walls or footings.

I. Excavations Made Under, Through, or Adjacent to New Footings: refilled with concrete as part of general construction work and cost for this additional concrete shall be paid by respective contractor for excavated work.

J. Pipe Penetrations Through Foundation Walls, Footings, or When Passing Below, or Adjacent to Structural Footings, or Bearing Points):
   A. Installed inside of a Class 52 Ductile Iron, or Schedule 40 Carbon Steel Pipe coated inside and outside with a bitumastic material as required to prevent stress or structural loading onto the pipe, fittings, and sleeves.
   B. Pipe and fittings below or adjacent to an underground structural member shall be protected anytime they are located within the zone of influence which extends downward from 45º below the furthest bottom edge of the structure.
   C. Pipe sleeve shall be a minimum of two (2) pipe sizes larger than the carrier pipe.
K. Bedding: Provided and installed for all piping and conduit and other installations where and as called for; minimum 4” below pipe (conduit) and up to center line of pipe (conduit). Bedding not required for concrete encased conduit.

L. Backfill: hand tamped in 3” layers up to 18” above pipe or conduit. Trenches inside building, within 10 feet of building and below structures, paving, walks, etc. shall be thoroughly tamped and machine compacted up to finished grade in compliance with specifications for general construction backfilling. Flooding will not be allowed. Trenches not inside building or not below structures and paving shall be hand tamped or machine compacted in approximately 8” layers.

M. Pipe extending up though concrete slab-on grade shall be

N. Excess Dirt, Bedding and Fill Material: removed from premises.

O. All Settlement: refilled up to finished grade.

P. Provide a full pipe sized, manual, 3-valve by-pass at all water treatment installations, pump installations, etc. Do not install by-passes around backflow preventers, unless the second full size backflow preventer of the same type is being provided in a parallel piped fashion.

3.08 MODIFICATIONS, CUTTING AND PATCHING (Includes New Work in Place)

A. This item is supplementary to cutting and patching requirements in the General Conditions.

B. It is required that all the work shall be complete and finished in every respect where attachments or alterations are made in and to new construction and present building(s) (if any). When applicable, work shall include all necessary modifications and restoration necessary for a complete result whether shown or not. Typically, work will include plaster patching, painting, repair of structure (flooring, base, trim, exterior masonry and stone work, etc.), and all rerouting of mechanical and electrical work. Temporary connections for existing mechanical and electrical installations (if any) shall be provided by respective contractor as required to maintain existing facilities in service during construction.

C. All work of cutting and patching of existing work necessary for the complete installation of respective work shall be the responsibility of respective contractor installing new work. Cutting and patching shall be performed by competent tradesmen qualified for respective work, to the complete satisfaction to the Architect/Engineer. Pavement and concrete slabs shall be saw cut to a minimum depth of 2” before material can be cut/broken up for removal.

D. Shoring and Bracing: provided by respective contractor for all present construction and installation as required to adequately protect same during modification of any existing work and installation of new work.

E. Particular care shall be taken at all times to keep existing building(s) watertight and protected from the elements. All damages to present areas shall be repaired by respective contractor to the approval of Owner at completion of the job.

F. Contractor: as work progresses remove and dispose from premises all debris and materials occasioned by demolition and alterations, and shall keep and leave the building(s) and premises clean.

3.09 LINTEL REQUIREMENTS

A.Lintels will be provided with General construction Work where shown and specified in General Construction Drawings and Specifications.
B. Work requiring openings through walls where lintels are not indicated with General Construction, shall have lintels provided as part of the work requiring opening, installed by experienced tradesmen.

3.10 REUSED ITEMS
A. Second-hand or Salvaged Materials: NOT to be incorporated in new work unless specifically called for on drawings or in specifications.

B. Items Designated to be Reused: carefully removed, protected from damage while in storage, cleaned, rebuilt as indicated, adjudged acceptable for reuse and reinstalled as shown, complete with new miscellaneous hardware and accessories as required.

3.11 OBSOLETE EQUIPMENT MATERIALS (Includes New Work being modified)
A. Remove all respective equipment, materials, conduit, pipe valves, boxes, etc. which are made obsolete by renovation work and all such items which must be removed to allow installation of new work of any trade.

B. Owner shall have first right of refusal of all material and equipment being removed from the property.

C. Remove items to remain property of the Owner and place them in room or area designated by Owner for storage.

D. All removed items not wanted by Owner shall become the property of the respective Contractor and shall be removed from the site by him.

E. Contractor shall include in bid proposal a cost to recycle all mercury from fluorescent lamps and recycle non-PCB ballast, also to remove and incinerate PCB filled ballast.

F. All above-mentioned items are to be removed handled, shipped and disposed of per local, state and federal laws.

3.12 SITE UTILITIES
A. Cut into, extend, reroute or relocate respective utilities as shown on drawings and/or specified and required.

1. Costs: included in Contractor's bid for the following when applicable:
   a. All service connection fees and permits.
   b. All charges by utilities for costs of service installation and all charges related to compliance with codes and ordinances.
   c. All items required by utility to be furnished by the customer.

2. All applicable requirements and standards included in this and other sections of the project manual govern work in this section.

B. Bidders: before bidding, verify with respective utility all current requirements in force, which apply to respective installations.

C. Installation of Utility Services: in accordance with all rules, regulations and requirements of, and approved, by Utility.
D. Sewers: installed in accordance with all rules, regulations and requirements of State and Local Authorities having jurisdiction and Indiana Department of Health and approved by Local Authority.

E. Interruption of service and scheduling of tie-in to utility lines shall be approved by Owner and Utility and coordinated by respective Contractor.

F. Verify respective utility requirements immediately prior to installation and connection and incorporate all requirements in force at the time of installation. If extra costs are anticipated, due to revised requirements, they shall be described in writing to Architect/Engineer and determined acceptable prior to performance of work.

G. Water Service: Pipe size shall be as shown on drawings inside building and from meter(s) to building. Pipe size between main and meter and size of meter and meter pit shall be verified with Utility before bidding.

3.13 START-UP AND ADJUSTMENT

A. Check all respective equipment and systems for correct connection (rotating, etc.), adjustment and operation. All moving parts shall be lubricated (oil reservoirs and pressure fittings filled) per manufacturer's instructions.

B. Clean all strainers in respective piping work. All filters and filter media shall be checked and all air handling equipment, which has been operated during construction, shall be replaced with clean specified filters or filter media prior to balancing and testing.

C. All Equipment and Systems: started and adjusted to function as intended and to produce design capacities, see Air System Adjusting and Balancing Section.

3.14 CLEANING-UP AT PROJECT CLOSEOUT

A. Clean-Up required by General Conditions shall include the following:

1. Replace all respective throwaway type filters or media used during construction and testing with clean specified filters or media at the time building is turned over to Owner. Filters or media replaced for performance testing and balancing do not have to be replaced if filters are as specified and have not become dirty.

2. Clean all permanent type filters or media and replace all throwaway type filters or media in all air handling equipment that has been operated during construction.

3. Clean all strainers in their respective piping work at the time the building is turned over to the Owner. This cleaning shall be in addition to cleaning before system testing and balancing if turnover occurs more than 30 days after testing and balancing.

END OF SECTION 019030
SECTION 02 30 00 - EARTHWORK

PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section Includes:
      1. Preparing subgrades for slabs-on-grade.
      2. Excavating and backfilling for buildings and structures.
      3. Drainage course for concrete slabs-on-grade.

   B. The Work includes but is not limited to:
      1. Repair of existing site conditions resulting from the work.
      2. All testing of sub-slab materials, soil bearing at footings, or otherwise of existing soil
         bearing conditions shall be the responsibility of the Contractor at its expense.

1.03 DEFINITIONS
   A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
      1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to
         support sides of pipe.
      2. Final Backfill: Backfill placed over initial backfill to fill a trench.
   B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt
      paving.
   C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before
      laying pipe.
   D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
   E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward
      capillary flow of pore water.
   F. Excavation: Removal of material encountered above subgrade elevations and to lines and
      dimensions indicated.
      1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond
         indicated lines and dimensions as directed by Architect. Authorized additional
         excavation and replacement material will be paid for according to Contract provisions for
         changes in the Work.
      2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated
         lines and dimensions without direction by Architect. Unauthorized excavation, as well as
         remedial work directed by Architect, shall be without additional compensation.
   G. Fill: Soil materials used to raise existing grades.
H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.04 SUBMITTALS
A. Product Data: For each type of the following manufactured products required:
B. Qualification Data: For qualified testing agency.
C. Material Test Reports: For each borrow material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487.
   2. Laboratory compaction curve according to ASTM D 698 or ASTM D 1557.

1.05 QUALITY ASSURANCE
A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.06 PROJECT CONDITIONS
A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
B. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.
C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures are in place.

PART 2 - PRODUCTS
2.01 SOIL MATERIALS
A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 PREPARATION
A. Protect structures, utilities, sidewalks, pavements, trees designated on the Civil drawings for protection, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
B. Protect and maintain erosion and sedimentation controls during earth moving operations.
C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 EXPLOSIVES
A. Explosives: Do not use explosives.

3.03 EXCAVATION, GENERAL
A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

3.04 EXCAVATION FOR STRUCTURES
A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

3.05 STORAGE OF SOIL MATERIALS
A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.06 BACKFILL
A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.07 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.08 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.09 COMPACtion OF SOIL BACKFILLS AND Fills

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 or ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, paved driving surfaces and walkways abutting driving surfaces, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways not abutting driving surfaces, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.
3.10 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
3. Finely grade areas behind curbs to a level even with the top of the curb.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.11 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
2. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.12 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: The Contractor shall engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other
footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.

2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.

3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.

3.13 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.14 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 02 30 00
SECTION 02 75 10 - CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section Includes:
      1. Provide fiber reinforced, air entrained concrete at all exterior locations.

1.03 SUBMITTALS
   A. Material Certificates: For the following, from manufacturer:
      1. Cementitious materials.
      2. Admixtures.

1.04 QUALITY ASSURANCE
   A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
      1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
   B. ACI Publications: Comply with ACI 301 unless otherwise indicated.

1.05 PROJECT CONDITIONS
   A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.01 FORMS
   A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
   B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.02 REINFORCEMENT
   A. Provide fiber reinforcement.
2.03 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C 150, portland cement Type I. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class C.

B. Normal-Weight Aggregates: ASTM C 33, uniformly graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: 1 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: Potable and complying with ASTM C 94.


E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

2.04 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Water: Potable.

2.05 CONCRETE MIXTURES

A. Proportion mixtures to provide normal-weight concrete with the following properties:
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
   3. Slump Limit: 4 inches, plus or minus 1 inch.

B. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
   1. Air Content: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use high-range, water-reducing admixture in concrete as required for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
E. Cementitious Materials: Limit percentage by weight of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.

2.06 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94 and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.

2. Provide tie bars at sides of paving strips where indicated.

3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
C. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes.

D. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes.

3.05 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Moisten subbase 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.

C. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

D. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

F. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

G. Screed paving surface with a straightedge and strike off.

H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

I. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist.

3.06 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.07 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

3.08 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/2 inch.

3.09 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 02 75 10
SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
      1. Including concrete mix designs.
   B. See Contract Drawings Sheet S001 for additional requirements.

1.3 DEFINITIONS
   A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
   B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
      1. Indicate amounts of mixing water to be withheld for later addition at Project site.
   C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
   D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
      1. Location of construction joints is subject to approval of the Architect.
   E. Samples: For vapor retarder.

1.5 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For Installer, manufacturer and testing agency.
   B. Material Certificates: For each of the following, signed by manufacturers:
      1. Cementitious materials.
      2. Admixtures.
      3. Form materials and form-release agents.
      4. Steel reinforcement and accessories.
5. Curing compounds.
7. Adhesives.
8. Vapor retarders.

C. Material Test Reports: For the following, from a qualified testing agency:
   1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 4.4 deg C (40 deg F) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301M (ACI 301).
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301M (ACI 301) and as follows:
   1. Maintain concrete temperature below 32 deg C (90 deg F) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

   A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
      1. ACI 301M (ACI 301).
      2. ACI 117M (ACI 117).

2.2 FORM-FACING MATERIALS

   A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
      1. Plywood, metal, or other approved panel materials.
      2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
         a. High-density overlay, Class 1 or better.
         b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
         c. Structural 1, B-B or better; mill oiled and edge sealed.
         d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

   B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

   C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 19 by 19 mm (3/4 by 3/4 inch), minimum.

   D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

   E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

   F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that leave no corrodible metal closer than 25 mm (1 inch) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 25 mm (1 inch) in diameter in concrete surface.

2.3 STEEL REINFORCEMENT
A. Reinforcing Bars: ASTM A 615/A 615M, Grade 420 (Grade 60), deformed.
B. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.
C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES
A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 420 (Grade 60), plain-steel bars, cut true to length with ends square and free of burrs.
B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS
A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
B. Cementitious Materials:
   2. Fly Ash: ASTM C 618, Class F or C.
C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
D. Air-Entraining Admixture: ASTM C 260/C 260M.
E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
G. Rapid Drying Concrete. Basis of Design Product: Subject to compliance with requirements, provide Aridus Rapid Drying Concrete or a comparable product approved by addendum prior to acceptance of bids. Provide Aridus Rapid Drying Concrete 85% R.H. at 45 days.

2.6 VAPOR RETARDERS
A. Sheet Vapor Retarder: ASTM E 1745, Class A, not less than 15 mils thick.

2.7 CURING MATERIALS
A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 305 g/sq. m (9 oz./sq. yd.) when dry.
C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
D. Water: Potable.
E. Topical curing products shall NOT be used.

2.8 RELATED MATERIALS
B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.
C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.9 REPAIR MATERIALS
A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 3.2 mm (1/8 inch) and that can be feathered at edges to match adjacent floor elevations.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 3.2 to 6 mm (1/8 to 1/4 inch) or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 29 MPa (4100 psi) at 28 days when tested according to ASTM C 109/C 109M.
B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 6.4 mm (1/4 inch) and that can be filled in over a scarified surface to match adjacent floor elevations.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 3.2 to 6 mm (1/8 to 1/4 inch) or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 34.5 MPa (5000 psi) at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301M (ACI 301).

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete, as required, for placement and workability.

2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Not less than:

1. Footings and Piers: Proportion normal-weight concrete mixture as follows:
   a. Minimum Compressive Strength: 27.6 MPa (4000 psi) at 28 days.
   b. Maximum Water-Cementitious Materials Ratio: 0.45.
   c. Slump Limit: 125 mm (5 inches) or 200 mm (8 inches) for concrete with verified slump of 50 to 100 mm (2 to 4 inches) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 25 mm (1 inch).
   d. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 38-mm (1-1/2-inch) nominal maximum aggregate size.

2. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
   a. Minimum Compressive Strength: 27.6 MPa (4000 psi) at 28 days.
   b. Minimum Cementitious Materials Content: 320 kg/cu. m (540 lb/cu. yd.).
   c. Slump Limit: 125 mm (5 inches), plus or minus 25 mm (1 inch).
   d. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 38-mm (1-1/2-inch) nominal maximum aggregate size.
e. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.12 FABRICATING REINFORCEMENT
A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING
A. Readied Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
1. When air temperature is between 30 and 32 deg C (85 and 90 deg F), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 32 deg C (90 deg F), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION
3.1 FORMWORK INSTALLATION
A. Design, erect, shore, brace, and maintain formwork, according to ACI 301M (ACI 301), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117M (ACI 117).
C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 3.2 mm (1/8 inch) for smooth-formed finished surfaces.
   2. Class B, 6 mm (1/4 inch) for rough-formed finished surfaces.
D. Construct forms tight enough to prevent loss of concrete mortar.
E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.
F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
H. Chamfer exterior corners and edges of permanently exposed concrete.
I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
3.2 EMBEDDED ITEM INSTALLATION
A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.3 REMOVING AND REUSING FORMS
A. General: Formwork for sides of walls, piers, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 10 deg C (50 deg F) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR-RETARDER INSTALLATION
A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints 150 mm (6 inches) and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION
A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 38 mm (1-1/2 inches) into concrete.
   3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   4. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 3.2 mm (1/8 inch). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 3.2-mm- (1/8-inch-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 13 mm (1/2 inch) or more than 25 mm (1 inch) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301M (ACI 301).
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301M (ACI 301).
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 150 mm (6 inches) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.8 FINISHING FORMED SURFACES
A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view or to receive a rubbed finish.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces indicated.
   2. Finish surfaces to the following tolerances, according to ASTM E 1155M (ASTM E 1155), for a randomly trafficked floor surface:
      a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:
   1. Coordinate sizes and locations of concrete bases with actual equipment provided.
   2. Construct concrete bases 150 mm (6 inches) high unless otherwise indicated and extend base not less than 150 mm (6 inches) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
   3. Minimum Compressive Strength: 27.6 MPa (4000 psi) at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 450-mm (18-inch) centers around the full perimeter of concrete base.

5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.

6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301M (ACI 301) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 1 kg/sq. m x h (0.2 lb/sq. ft. x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 300-mm (12-inch) lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 300 mm (12 inches), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
      c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 50 mm (2 inches) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a 1.18-mm (No. 16) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 13 mm (1/2 inch) in any dimension to solid concrete. Limit cut depth to 19 mm (3/4 inch). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.25 mm (0.01 inch) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 6 mm (1/4 inch) to match adjacent
floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 25 mm (1 inch) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 19-mm (3/4-inch) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 25 mm (1 inch) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 4 cu. m (5 cu. yd.), but less than 19 cu. m (25 cu. yd.), plus one set for each additional 38 cu. m (50 cu. yd.) or fraction thereof.

2. Testing Frequency: Obtain at least one composite sample for each 76 cu. m (100 cu. yd.) or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 4.4 deg C (40 deg F) and below or 27 deg C (80 deg F) and above, and one test for each composite sample.

6. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

7. Compression Test Specimens: ASTM C 31/C 31M.
a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

10. Strength of each concrete mixture will be satisfactory if every average of any three-consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 3.4 MPa (500 psi).

11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

C. Measure floor and slab flatness and levelness according to ASTM E 1155M (ASTM E 1155) within 24 hours of finishing.

END OF SECTION 03 30 00
SECTION 04 81 00 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes:
   1. Concrete masonry units.
   2. Face brick.
   3. Manufactured stone trim.
   4. Mortar and grout.
   5. Steel reinforcing bars.
   7. Ties and anchors.
   8. Embedded flashing:
      a. Including S.S. drip at wall base.
      a. See specification section 07 21 00 – Building Insulation for Dow Air Barrier System.
B. The Work includes, but is not limited to:
   1. Repair of existing masonry as required for installation of new work.
   2. New face brick.
   3. Other work as indicated on the drawings.
C. The Work includes Tuck Pointing:
   1. See Specifications Section 01 02 60 – Unit Prices.
D. Related Sections:
   1. Division 3 Section "Cast-in-Place Concrete".
   2. Division 5 Section "Metal Fabrications" for furnishing steel lintels for unit masonry.

1.03 DEFINITIONS
A. CMU(s): Concrete masonry unit(s).
B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.
1.04 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.
   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
   2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Insulation System: Submit insulation Manufacturer’s recommendations for installation of air barrier system.
C. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement.
   3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
D. Samples for Initial Selection:
   1. Face brick in the form or display panels.
E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers’ product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
   1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
F. Qualification Data: For testing agency.
G. Material Certificates: For each type and size of the following:
   1. Masonry units.
H. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of typical wall area.
   2. Build mockups for typical exterior/interior wall in sizes approximately 60 inches long by 72 inches high by full thickness.
      a. Include a sealant-filled joint at least 16 inches long in mockup.
      b. Include through-wall flashing.
      c. Include air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
   3. Erect mockups adjacent and parallel to existing surface.
   4. Clean exposed faces of mockups with masonry cleaner as indicated.
   5. Protect accepted mockups from the elements with weather-resistant membrane.
   6. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
      a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
      b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
   7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.07 DELIVERY, STORAGE, AND HANDLING

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

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

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

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

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

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

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

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

B. 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.

C. 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.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. 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 ACI 530.1/ASCE 6/TMS 602.

1. 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.


PART 2 - PRODUCTS

2.01 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.02 MASONRY LINTELS

A. MasonryLintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

B. Provide above all hollow metal door openings.
2.03  BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Facing brick complying with ASTM C 216.

1. Base Bid - Available Products: Subject to compliance with requirements, provide the following:
   a. Provide brick substantially matching color and texture of brick at existing building.

2. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."


2.04  MANUFACTURED STONE TRIM

A. Full depth for installation in full depth brick masonry.

B. Available Products: Subject to compliance with requirements, provide the following:

1. Cultured Stone by Boral
   a. 200 Mansell Court E. Suite 305; Roswell, GA

2. Other Manufacturer approved by addendum prior to the receipt of bids.

2.05  MORTAR AND GROUT MATERIALS

A. Tuck Pointing Mortar: As specified in ASTM C270, appendix X3.

B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Masonry Cement: ASTM C 91.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Essroc, Italcementi Group; Brixment
b. Lafarge North America Inc.

c. Lehigh Cement Company.

F. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.


H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Euclid Chemical Company (The); Accelguard 80.


   c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

I. Water: Potable.

2.06 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

   1. Interior Walls: Hot-dip galvanized, carbon steel.

   2. Exterior Walls: Hot-dip galvanized, carbon steel.


   5. Wire Size for Veneer Ties: 0.148-inch diameter.

   6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.

   7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multi-wythe Masonry:

   1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.07 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

2.08 MISCELLANEOUS ANCHORS
A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
B. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.09 EMBEDDED FLASHING MATERIALS
A. Metal Flashing/drip edge: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
   1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
   B. Flexible Flashing: Use the following unless otherwise indicated:
      1. Asphalt-Coated Copper Flashing: 7-oz./sq. ft. copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.
         a. Products: Subject to compliance with requirements, provide one of the following:
            1) Advanced Building Products Inc.; Cop-R-Cote.
            2) Dayton Superior Corporation, Dur-O-Wal Division; Copper Coated Thru-Wall Flashing.
            3) Hohmann & Barnard, Inc.; H & B C-Coat Flashing.
            4) Phoenix Building Products; Type ACC-Asphalt Bituminous Coated.
            5) Sandell Manufacturing Co., Inc.; Coated Copper Flashing.
         b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
   C. Application: Unless otherwise indicated, use the following:
      1. Where flashing is indicated to receive counter flashing, use metal flashing.
      2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
      3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
      4. Where flashing is fully concealed, use metal flashing or flexible flashing.
   D. Solder and Sealants for Sheet Metal Flashings:
      1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

3. Elastomeric Sealant: ASTM C 920, chemically curing sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent formulated from neoprene, urethane, or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I.

D. Weep/Vent Products: Use the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) Advanced Building Products Inc.; Mortar Maze weep vent.
      2) Blok-Lok Limited; Cell-Vent.
      3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
      4) Heckmann Building Products Inc.; No. 85 Cell Vent.
      5) Hohmann & Barnard, Inc.; Quadro-Vent.
      6) Wire-Bond; Cell Vent.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products: Subject to compliance with requirements, provide the following:

   a. Advanced Building Products Inc.
   b. Archovations, Inc.
   c. Mortar Net.

2. Provide the following configuration:

   a. Strips full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.

2.11 INSULATION

A. Air Barrier Wall System with Liquid Armor sealant flashing:

1. System to be installed over CMU.
B. Install insulation as described in Dow Chemical Company, Dow building solutions technical bulletin: “How to install the Ultra Air Barrier Wall System”.

C. Available Manufacturers / basis of bid: Provide product recommended by one of the following manufacturers for intended use:

2. Other manufacturer approved by addendum prior to the receipt of bids.

D. Material Properties:

1. Rigid closed cell extruded polystyrene foam insulation.
2. Comply with ASTM C 578-95, Type IV, density 1.6 lb/cu. ft. min., compressive resistance 25 psi (ASTM D 1621-94)
3. Thermal resistance: R-12; 5-year aged R-values of 6.0 and 5.6 min. ºF-ft2 -h/Btu2 /inch at 40°F and 75°F respectively (ASTM C 518-91).
4. Water absorption: Max. 0.1% by volume (ASTM C 272-91(96)).
6. Thickness: Nominal 2”.

2.12 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.13 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use masonry cement or mortar cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, [Proportion] [Property] Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior non-load-bearing partitions, Type O may be used instead of Type N.
D. Grout for Unit Masonry: Comply with ASTM C 476.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

3.03 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
   2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet maximum.

3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet maximum.

4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet maximum.

5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet maximum.

6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet.

7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch with a maximum thickness limited to 1/2 inch.

2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.

3.04 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Face Brick Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern to match existing building do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Bond Pattern for Exposed CMU Masonry: Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.

3.05 MORTAR BEDDING AND JOINTING

A. Lay brick and CMUs as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
   4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
   1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

3.06 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:
      a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable two-piece type reinforcement with continuous horizontal ladder type reinforcement with eyes in the CMU and pintel type attachment to the face brick.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Installing Cavity-Wall Insulation:
   1. Apply 2” diameter daubs of adhesive spaced approximately 12” o.c. both ways on inside face of insulation board.
   2. Butter all edges of insulation board with adhesive to provide continuous vapor barrier.
   3. Fit insulation between wall ties and other obstructions with joints staggered and edges butted tightly.
      a. Press units firmly against inside wythe of masonry or other construction.
      b. Wedge insulation from outside wythe of construction with small fragments of masonry materials spaced 24” o.c. both ways.
      c. Make insulation continuous. Fill all voids.

3.07 MASONRY JOINT REINFORCEMENT

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

3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.08 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.

2. Install preformed control-joint gaskets designed to fit standard sash block.

3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.

4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.

2. Build flanges of factory-fabricated, expansion-joint units into masonry.

3. Build in compressible joint fillers where indicated.

4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 7 Section "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.09 LINTELS

A. Install steel lintels where indicated and additionally at all locations as needed for bearing.

B. Provide lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General:

1. Weep Holes: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

2. Wall Vents: Install vents at a minimum of 48 inches o.c. and additionally at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 4 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.

3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches. Follow insulation manufacturer’s instructions for termination at top of flashing.

4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 7 Section "Joint Sealants" for application indicated.

6. Install metal drip edges beneath flexible flashing at exterior face of wall. Follow insulation manufacturer’s instructions for termination at drip edge.

7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.

2. Space weep holes 24 inches o.c. unless otherwise indicated.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

F. Install vents in head joints in exterior wythes at 48 inch o.c.. Use specified weep/vent products to form vents.
3.11 FIELD QUALITY CONTROL
A. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
B. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
C. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
D. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for compressive strength.
E. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
F. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.12 PARGING
A. Parge cavity wall (Interior) side of exterior face brick to assure minimal intrusion into the free air space. Do **not** cut mortar free and allow it to drop into airspace.

3.13 TUCK POINTING
A. Removal of unsound material:
   1. Cut out existing mortar joints (both bed and head joints) and remove by means of a tooting chisel or a special pointer's grinder, to a uniform depth of to 19 mm (3/4-inch), or until sound mortar is reached. Take care to not damage edges of existing masonry units to remain.
   2. Remove dust and debris from the joints by brushing, blowing with air or rinsing with water. Do not rinse when temperature is below freezing.
B. Installation of Tuck Pointing Mortar:
   1. Immediately prior to application of mortar, dampen joints to be tuck pointed. Prior to application of pointing mortar, allow masonry units to absorb surface water.
   2. Tightly pack mortar into joints in thin layers, approximately 6 mm (1/4-inch) thick maximum.
   3. Allow layer to become "thumbprint hard" before applying next layer.
   4. Pack final layer flush with surfaces of masonry units. When mortar becomes "thumbprint hard", tool joints.
C. Tooling Joints:
   1. Tool joints with a jointing tool to produce a smooth, compacted, concaved joint.
   2. Tool joints in patch work with a jointing tool to match the existing surrounding joints.

3.14 REPAIRING, POINTING, AND CLEANING
A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

3.15 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2 Section "Earthwork."
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 81 00
SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section Includes:
      1. Loose Steel Lintels.
   B. The Work Includes:
      1. Galvanized loose steel lintels for use with masonry walls.
      2. Other work indicated on the Drawings.

1.03 PERFORMANCE REQUIREMENTS
   A. Delegated Design: Design ladders including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.04 SUBMITTALS
   A. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

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

1.06 PROJECT CONDITIONS
   A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

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

2.02 FASTENERS
   A. General: Unless otherwise indicated, provide stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941.
(ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.

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

2.04 FABRICATION, GENERAL
A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
D. Form exposed work with accurate angles and surfaces and straight edges.
E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.
F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
G. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
H. Provide for anchorage of type recommended by designated design engineer.

2.05 MISCELLANEOUS FRAMING AND SUPPORTS
A. General: Provide framing and supports not specified in other Sections as needed to complete the Work.

2.06 LOOSE STEEL LINTELS
A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

### 2.07 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

#### 3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

#### 3.03 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION 05 50 00
SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

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

1.2 SUMMARY
   A. The Work includes but is not limited to the following:
      1. Wood Framing.
      2. Wood blocking and backing panels.
      3. Other Rough Carpentry as required for the completion of the work.
   B. See Contract Drawings Sheet S001 for additional requirements.
   C. Related Sections include the following:
      1. Division 31 Section "Termite Control" for site application of borate treatment to wood framing.

1.3 SUBMITTALS
   A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 QUALITY ASSURANCE
   A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING
   A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL
   A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER
   A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no 
arsonic or chromium.

2. For exposed items indicated to receive a stained or natural finish, use chemical 
formulations that do not require incising, contain colorants, bleed through, or otherwise 
adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use 
material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board 
of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of 
each piece.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar 
members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in 
contact with masonry or concrete.

3. Wood framing and furring attached directly to the interior of below-grade exterior 
masonry or concrete walls.

4. Wood framing members that are less than 18 inches (460 mm) above the ground in 
crawlspace or unexcavated areas.

2.3 ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain 
primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and 
made with an exterior-type adhesive complying with ASTM D 2559 and containing no 
urea formaldehyde.

2.4 MISCELLANEOUS LUMBER

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

1. Blocking.

2. Nailers.

B. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber 
of any species may be used provided that it is cut and selected to eliminate defects that will 
interfere with its attachment and purpose.

C. For blocking and nailers used for attachment of other construction, select and cut lumber to 
eliminate knots and other defects that will interfere with attachment of other work.

D. For furring strips for installing plywood or hardboard paneling, select boards with no knots 
capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, fire-retardant treated, in 
thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.
2.6 FASTENERS
   A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL
   A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION
   A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
   B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
   C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
   D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION
   A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
   B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00
SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

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

1.2 SUMMARY
   A. The Work includes but is not limited to:
      1. Wall sheathing.
   B. See Contract Drawings Sheet S001 for additional requirements.

1.3 SUBMITTALS
   A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 DELIVERY, STORAGE, AND HANDLING
   A. Stack panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL SHEATHING
   A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
      1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corporation.
   B. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
      1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
      2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.
PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
5. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."
6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's "International One- and Two-Family Dwelling Code."

D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with nails or screws.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
4. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.
C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

3.3 FOAM-PLASTIC SHEATHING INSTALLATION

A. Comply with manufacturer's written instructions.

3.4 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
3. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.5 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
4. Lap weather-resistant building paper over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.6 PROTECTION

A. Paper-Surfaced Gypsum Sheathing: Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing. Apply covering immediately after sheathing is installed.

END OF SECTION 06 16 00
SECTION 06 17 60 - METAL-PLATE-CONNECTED WOOD TRUSSES

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes the following:
   1. Wood roof trusses.

B. See Contract Drawings Sheet S001 for additional requirements.

1.3 DEFINITIONS
A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.4 PERFORMANCE REQUIREMENTS
A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
   1. Design Loads: As indicated.

1.5 SUBMITTALS
A. Shop Drawings:
   1. Provide shop drawings stamped and certified by a Structural Engineer licensed to practice in the State of Indiana.
      a. See Construction Documents Sheet S001 for design criteria.

PART 2 - PRODUCTS

2.1 GENERAL
A. See Construction Documents Sheet S001.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install wood trusses only after supporting construction is in place and is braced and secured.
B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

G. Replace wood trusses that are damaged or do not meet requirements.
   1. Do not alter trusses in field.

END OF SECTION 06 17 60
SECTION 06 20 10 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

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

1.2 SUMMARY
   A. This Section includes the following:
      1. Exterior standing and running trim.
      2. Exterior wood columns.
   B. Related Sections include the following:
      1. Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry.

1.3 SUBMITTALS
   A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1.4 DELIVERY, STORAGE, AND HANDLING
   A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.

1.5 PROJECT CONDITIONS
   A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.
      1. For exterior ornamental wood columns, comply with manufacturer's written instructions and warranty requirements.
   B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
      1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
      2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL
   A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.
1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece.

B. Softwood Plywood: DOC PS 1.

2.2 STANDING AND RUNNING TRIM
A. Lumber Trim for Painted Finish:
   1. Species and Grade: Eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods; D Select; NeLMA, NLGA, WCLIB, or WWPA.
   2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
   4. Face Surface: Surfaced smooth

B. Plywood Type: APA-rated
C. Thickness: As indicated.
D. Face Species: Southern pine.
E. Pattern: Plain.

2.3 MISCELLANEOUS MATERIALS
A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.

B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.

2.4 FABRICATION
A. Back out or kerf backs of standing and running trim wider than 5 inches except members with ends exposed in finished work.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Clean substrates of projections and substances detrimental to application.
B. Prime lumber to be painted, including both faces and edges. Cut to required lengths and prime ends. Comply with requirements in Division 9 Section "Exterior Painting."

### 3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
3. Coordinate exterior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

### 3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long except where necessary.

1. Use scarf joints for end-to-end joints.
2. Stagger end joints in adjacent and related members.

B. Fit exterior joints to exclude water. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

### 3.5 ADJUSTING

A. Replace exterior finish carpentry that is damaged or does not comply with requirements. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

### 3.6 CLEANING

A. Clean exterior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

### 3.7 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

END OF SECTION 06 20 10
SECTION 06 65 10 – SOLID SURFACE FABRICATIONS

PART 1 - GENERAL

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

1.02 SUMMARY
   A. This Section includes but is not limited to:
      1. Window sills.
      2. Other as indicated on the contract drawings.
   B. Related sections include the following:
      1. Division 6 Section “Rough Carpentry” for Blocking.

1.03 DEFINITION
   A. Solid surface is defined as nonporous, homogeneous material maintaining the same
      composition throughout the part with a composition of acrylic polymer, aluminum
      trihydrate filler and pigment.

1.04 SUBMITTALS
   A. Product Data: for each type of product indicated.
   B. Shop drawings:
      1. Show location of each item, dimensioned plans and elevations, large-scale
         details, attachment devices and other components.
      2. Show full-size details, edge details, thermoforming requirements, attachments,
         etc.
      3. Show locations and sizes of furring, blocking, including concealed blocking and
         reinforcement specified in other Sections.
      4. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets,
         soap dispensers, waste receptacle and other items installed in solid surface.
   C. Samples. For each type of product indicated:
      1. Submit minimum 6-inch by 6-inch sample in specified gloss.
      2. Cut sample and seam together for representation of inconspicuous seam.
      3. Indicate full range of color and pattern variation.
      4. Approved samples will be retained as a standard for work.
   D. Product data: Indicate product description, fabrication information and compliance
      with specified performance requirements.
   E. Maintenance data:
1. Submit manufacturer’s care and maintenance data, including repair and cleaning instructions.

2. Maintenance kit for finishes shall be submitted. Include in project closeout documents.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.

B. Fabricator/installer qualifications:
   1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.

C. Applicable standards:
   1. Standards of the following, as referenced herein:
      a. American National Standards Institute (ANSI)
      b. American Society for Testing and Materials (ASTM)
      c. National Electrical Manufacturers Association (NEMA)
      d. NSF International
   2. Fire test response characteristics:
      a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
         a. Flame Spread Index: 25 or less.
         b. Smoke Developed Index: 450 or less.

D. Pre-installation conference:
   1. Conduct conference at project site to comply with requirements in Division 1.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver no components to project site until areas are ready for installation.

B. Store components indoors prior to installation.

C. Handle materials to prevent damage to finished surfaces.
   1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.07 WARRANTY

A. Provide manufacturer’s warranty against defects in materials.
   1. Warranty shall provide material and labor to repair or replace defective materials.
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:
   1. Basis of Design: Corian® surfaces from the DuPont company,
      a. Color: To be selected from manufacturer’s standards.
   2. Swanstone from The Swan Corporation,
   3. Wilsonart,
   4. Formica® Solid Surfacing,
   5. Or approved equal prior to submitting bids.

2.02 MATERIALS

A. Solid polymer components
   1. Cast, nonporous, filled polymer, not coated, laminated or of composite
      construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6,
      having minimum physical and performance properties specified.
   2. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by
      sanding and/or polishing.
   3. Thickness: ½”

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with fabricator present for compliance
   with requirements for installation tolerances and other conditions affecting
   performance of work.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance
   with approved shop drawing and product date.
   1. Provide product in the largest pieces available.
   2. Form field joints using manufacturer’s recommended adhesive, with joints
      inconspicuous in finished work.
   3. Exposed joints/seams shall not be allowed.
   4. Reinforce field joints with solid surface strips extending a minimum of 1 inch
      on either side of seam with the strip being the same thickness as the top.
   5. Cut and finish component edges with clean sharp returns.
   6. Anchor securely to base cabinets or other supports.
   7. Align adjacent countertops and form seams to comply with manufacturer’s
      written recommendations using adhesive in color to match countertop.
8. Carefully dress joints smooth, remove surface scratches and clean entire surface.
9. Install countertops with no more than 1/8” (3mm) sag, bow or other variation from a straight line.

3.03 REPAIR
A. Repair or replace damaged work which cannot be repaired to architect’s satisfaction.

3.04 CLEANING AND PROTECTION
A. Keep components clean during installation.
B. Remove adhesives, sealants and other stains.

END OF SECTION 06 65 10
SECTION 07 21 00 - BUILDING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. The Work includes but is not limited to:

1. Perimeter foundation insulation.
2. Foam-Plastic Board Cavity Wall Insulation System
   a. Air Barrier insulation system for use in masonry cavity walls.
   b. NOTE: Wrap all blocking or other building materials exposed to the wall cavity including at door and windows with “peal-and-stick” membrane flashing.
   a. For sound insulation.
      1) Provide sound insulation at ALL interior metal stud and gyp. bd. walls unless noted otherwise.
   b. For thermal insulation at exterior stud walls.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated including:
   1. Each type of insulation product indicated.
   2. Flame retardant coating.
   3. Accessories to thermal barrier to be installed in masonry.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:
   1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
   3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 FOAM-PLASTIC BOARD FOUNDATION INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Manufacturers:
      a. Dow Chemical Company (The).
   2. Type IV, 25 psi.

2.02 FOAM-PLASTIC BOARD AIR BARRIER INSULATION SYSTEM

A. Air Barrier Wall System with mastic flashing:
   1. System to be installed over 5/8” exterior grade Gypsum Board.

B. Available Manufacturer:

C. Install insulation as described in Dow Chemical Company, Dow building solutions technical bulletin: “How to install the Ultra Air Barrier Wall System”.

D. Adhesive: The Insulation Board Manufacturer’s recommended single component insulating foam sealant or equal approved by insulation board manufacturer.

E. Accessories:
   1. Fasteners: Provide insulated sheathing manufacturer’s recommended polymer or other corrosion protective coated steel screw fasteners for securing rigid foam to the metal wall framing. Fastener length and size based on wall thickness and fastening requirements. Wall Anchors and/or Fasteners should not exceed a maximum distance of 8” from any insulation board edge when used as part of the fastening pattern installation.
      a. Acceptable Products: Rodenhouse Inc. w/ 1-3/4 inch diameter high-grade plastic washers or approved equal.
   2. Wall Opening Flashing: Provide insulated sheathing manufacturer’s recommended polyurethane foam for sealing penetrations of insulated sheathing.
a. Basis of bid product: WEATHERMATE™ Flashing or equal approved by addendum prior to submittal of bids.

b. Provide self-sealing, self-healing, fully adhered flashing engineered for exceptional adhesion to insulated sheathing, steel, masonry, concrete, gypsum.

F. Installation: Install insulation in accordance with manufacturer's recommendations. Fasten to exterior face of exterior metal stud wall framing using sheathing manufacturer’s recommended type and length screw fasteners with washers. Abut panels tightly together and around openings and length screw fasteners with washers. Abut panels tightly together and around openings and penetrations.

1. Install sheathing panels with length of boards oriented horizontally (ship-lapped edges). To allow for staggering of joints cut first insulation board in half to a 2’x8’ or 4’x4’ dimension depending on chosen orientation. Use maximum lengths to minimize number of joints. For the first course of rigid insulation provide a continuous 1” bead of Insulation Board Manufacturer’s recommended Insulating Foam Sealant so that the bottom edge on each insulation board will seat and create a seal between the bottom face of the foam and the foundation. Do this for the bottom course of insulation only. If installing base flashing use “Rodenhouse” fasteners in place of “Pos-i-tie” for first row from the bottom. This will allow for a flush mount of the installed base flashing. Insulation needs to be continuous with no interruptions full height and width of cavity. Use a table saw, skill saw and/or drywall trim saw when cutting insulation to ensure tight joints for quality of installation in achieving an air barrier system.

2. Fasten insulation panels to each support stud with fasteners spaced 12 inches on center at perimeter and 16 inches on center in panel field. Set back perimeter fasteners 3/8” from edges and ends of panel units. Use a minimum amount of wall fasteners to hold insulation in place until the wall anchors are installed. The wall anchor installation pattern is based on a horizontal and vertical spacing of 16” centers to comply with the ASTM 2357 air barrier testing requirements. If the noted fastening pattern for the wall anchors cannot be adhered to then additional wall fasteners will need to be added to the assembly to ensure that all board edges have an anchor or fastener within 8” of all board edges. Drive fasteners to bear tight and flush with surface of insulation. Do not countersink perimeter fasteners—they can be detailed to bridge the gap of abutting board joints due to the 1.75” diameter of the washer used to fasten the board to the studs. Maximum of two board joints may be bridged per fastener.

3. Wall ties shall be inserted through insulation board according to manufacturer’s instructions. Do not allow shaft of fastener to “drift” or “wobble”. Rubber washer on back of pintle shaft is intended to seal shaft hole in foam board insulation.

4. Install flashing joint tape at end and edge joints with sufficient hand pressure to ensure seal and in accordance with sheathing manufacturer's joint sealing recommendations.

5. Install flashing tape behind wall tie and mechanical fastening assemblies for rain screen claddings.

6. Seal sheathing joints and penetrations of sheathing in accordance with sheathing manufacturer's joint and penetration sealing recommendations.
7. Rigid foam shall be installed tight against the substrate both at the top and all edges. Fill gaps with Insulation Board Manufacturer’s recommended Insulating Foam Sealant. Where the through-wall flashing is installed behind the rigid insulation layer install a termination bar with a piece of Insulation Board Manufacturer’s recommended Straight Flashing Tape 4” wide with butyl rubber adhesive as a counter flashing. Install a bead of Insulation Board Manufacturer’s recommended Insulating Foam Sealant at the top of the counter flashing to provide the required air barrier performance characteristics.

8. Allow a maximum of a 2” gap at the top of the steel stud wall assembly when installing the rigid foam insulation layer. Close the gap with two component spray foam insulation not exceeding manufacturer’s product limitations. Openings greater than 2” are to be filled with rigid foam insulation pieces fastened to the steel framing per standard attachment methodology.

2.03 BLANKET INSULATION

A. Available Manufacturers: Provide product recommended by one of the following manufacturers for intended use:
   1. CertainTeed Corporation.
   2. Johns Manville.
   3. Owens Corning.

B. Glass-Fiber Blanket Insulation: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.03 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

3.04 INSTALLATION OF PERIMETER INSULATION

A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
   1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.

D. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

3.05 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces as required to maintain thermal barrier. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

3.06 SPRAY-APPLIED INSULATION

A. Apply spray-applied insulation according to manufacturer's written instructions.

3.07 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00
SECTION 07 24 13 - EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes:
   1. Integral color Exterior Insulation and Finish System (EIFS) applied over Gypsum Board.
      a. Including Moisture Drainage System on vertical walls.
   2. Fiberglass-mat Faced Type “X” Gypsum Sheathing.
   3. Caulking and Sealants.
   4. Submittals including manufacturer’s approved details.

1.03 SYSTEM DESCRIPTION
A. Class PB EIFS: A non-load-bearing, exterior wall cladding system that consists of an insulation board attached adhesively, mechanically, or both to the substrate; an integrally reinforced base coat; and a textured protective finish coat.

1.04 PERFORMANCE REQUIREMENTS
A. EIFS Performance: Comply with the following:
   1. Bond Integrity: Free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
   2. Weathertightness: Resistant to water penetration from exterior into EIFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish.
B. Class PB EIFS: Provide EIFS having physical properties and structural performance that comply with the following:
   1. Abrasion Resistance: Sample consisting of 1-inch thick EIFS mounted on 1/2-inch thick gypsum board; cured for a minimum of 28 days; and showing no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested per ASTM D 968, Method A.
   2. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per EIMA 101.01.
   3. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate, cured for 28 days, and showing no growth when tested per ASTM D 3273 and evaluated according to ASTM D 3274.
4. **Tensile Bond**: No failure in the EIFS, adhesive, base coat, or finish coat when tested per ASTM C297.

5. **Water Penetration**: Sample consisting of 1-inch thick EIFS mounted on 1/2-inch thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded-polystyrene board interface of the test specimen after 15 minutes at 2.86 lb/sq. ft. of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per ASTM E331.

6. **Impact Resistance**: Sample consisting of 1-inch thick EIFS when constructed, conditioned, and tested per EIMA 101.86; and meeting or exceeding the following:
   a. **High Impact Resistance**: 90 to 150 inch-lb.

### 1.05 SUBMITTALS

A. **Product Data**: For each type and component of EIFS indicated.

B. **Elevations of EIFS components indicating manufacturer’s recommended**:
   1. Control/expansion joint locations, include architectural joints.
   2. Installation details. Provide manufacturer’s recommended standard details.

C. **Samples for Initial Selection**: For each type of finish-coat color and texture indicated.
   1. Include similar Samples of joint sealants involving color selection.

D. **Samples for Verification**: 24-inch square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work including typical control joint filled with sealant of color selected.

E. **Maintenance Data**: For EIFS to include in maintenance manuals.

### 1.06 QUALITY ASSURANCE

A. **Installer Qualifications**: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.

   1. **Fabricator/Erector Qualifications**: Certified in writing by EIFS manufacturer as qualified to fabricate and erect manufacturer's prefabricated panel system using skilled and trained workers.

B. **Source Limitations**: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with system components.

C. **Fire-Test-Response Characteristics**: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

   1. **Fire-Resistance Characteristics**: Provide materials and construction tested for fire resistance per ASTM E 119.

   2. **Surface-Burning Characteristics**: Provide insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less.
1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
   1. Stack insulation board flat and off the ground.
   2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
   3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Maintain ambient temperatures above 40 deg F and below 100 deg F for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

B. Coordinate installation of EIFS with related Work specified in other Sections to ensure that wall assemblies, including sheathing, flashing, trim, joint sealants, windows, and doors, are protected against damage from the effects of weather, age, corrosion, moisture, and other causes. Do not allow water to penetrate behind flashing and barrier coating of EIFS.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Basis of Bid: Dryvit Systems, Inc.
      a. Outsulation Plus MD system.
      b. System shall include all materials from substrate to finish, including but not limited to:
         1) Water-resistant barrier,
         2) Insulation,
         3) Base coats,
         4) Reinforcing mesh,
         5) Finish Coat,
         6) Sealants,
         7) Drainage system.
   2. Substantially equal drained systems by:
      a. Senergy; Degussa Wall Systems, Inc.
      b. Sto Corp.
2.02 MATERIALS

A. Compatibility: Provide adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by EIFS manufacturer for Project.

B. Exterior Gypsum Board: 5/8” Fiberglass-Mat Faced Type “X” Gypsum Sheathing:
   1. Provide Georgia-Pacific Fireguard Sheathing.
   2. Fasteners: Wafer-head or flat-head steel drill screws complying with ASTM C 954, with an organic-polymer coating or other corrosion-protective coating having a salt-spray resistance of more than 500 hours per ASTM B 117.
      a. Size and Length: As recommended by sheathing manufacturer for type and thickness of sheathing board to be attached.

C. Primer/Sealer: EIFS manufacturer's standard substrate conditioner[ with VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24),] designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated and adhesive used for application of insulation.

D. Flexible-Membrane Flashing: Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

E. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate.

F. Molded, Rigid Cellular Polystyrene Board Insulation: Comply with ASTM C 578, Type I; EIFS manufacturer's requirements; and EIMA's "EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board" for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:
   1. EIFS Manufacturer’s recommended product.

G. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands:
   1. EIFS Manufacturer’s recommended product.

H. Base-Coat Materials: EIFS manufacturer's standard mixture.

I. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard Cell Class for use intended, and ASTM C 1063.

2.03 ELASTOMERIC SEALANTS

A. Elastomeric Sealant Products: Provide EIFS manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials, and complies with requirements for products and testing indicated in ASTM C 1481.

B. Preformed Foam Sealant Products: Provide sealant compatible with adjacent materials and complying with requirements in Division 07 Section "Joint Sealants."
MIXING

A. General: Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of EIFS.

B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Begin coating application only after surfaces are dry.

2. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.

C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

1. Concrete Substrates: Provide clean, dry, neutral-pH substrate for insulation installation. Verify suitability of substrate by performing bond and moisture tests recommended by EIFS manufacturer.

3.03 EXTERIOR GYPSUM BOARD INSTALLATION

A. Exterior Gypsum Board: Install on framing to comply with manufacturer's written instructions and evaluation report acceptable to authorities having jurisdiction. Install board with steel drill screws.

3.04 EIFS INSTALLATION, GENERAL

A. Comply with ASTM C 1397 and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.05 SUBSTRATE PROTECTION APPLICATION

A. Primer/Sealer: Apply over gypsum sheathing substrates to protect substrates from degradation and where required by EIFS manufacturer for improving adhesion of insulation to substrate.

B. Flexible-Membrane Flashing: Install over weather-resistant barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by EIFS.
manufacturer's written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with EIFS manufacturer's written instructions and details.

3.06 TRIM INSTALLATION
A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints according to EIFS manufacturer's written instructions. Coordinate with installation of insulation.

3.07 INSULATION INSTALLATION
A. Board Insulation: Attach insulation to substrate in compliance with ASTM C 1397, EIFS manufacturer's written instructions, and the following:
   1. Apply adhesive to insulation by notched-trowel method in a manner that results in providing vertical drainage channels.
B. Expansion Joints: Install at locations indicated, and additionally where required by EIFS manufacturer, and as follows:
   1. At expansion joints in substrates behind EIFS.
   2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
   3. At floor lines in multilevel wood-framed construction.
   4. Where wall height or building shape changes.
   5. Where EIFS manufacturer requires joints in long continuous elevations.

3.08 BASE-COAT INSTALLATION
A. Base Coat: Apply to exposed surfaces of insulation in minimum thickness recommended in writing by EIFS manufacturer.

3.09 FINISH-COAT INSTALLATION
A. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.
B. Finish Coat: Apply over dry base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

3.10 INSTALLATION OF JOINT SEALANTS
A. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements in Division 07 Section "Joint Sealants" and in ASTM C 1481.
   1. Apply joint sealants after base coat has cured but before applying finish coat.
   2. Clean surfaces to receive sealants to comply with indicated requirements and EIFS manufacturer's written instructions.
   3. Apply primer recommended in writing by sealant manufacturer for surfaces to be sealed.
   4. Install sealant backing to control depth and configuration of sealant joint and to prevent sealant from adhering to back of joint.
   5. Apply masking tape to protect areas adjacent to sealant joints. Remove tape immediately after tooling joints, without disturbing joint seal.
6. Recess sealant sufficiently from surface of EIFS so an additional sealant application, including cylindrical sealant backing, can be installed without protruding beyond EIFS surface.

3.11 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 07 24 13
SECTION 07 31 10 - ASPHALT SHINGLES

PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section Includes:
      1. Asphalt shingles.
      2. Underlayment.
      3. Vapor barrier.
   B. Related Sections:
      1. Division 6 Section "Rough Carpentry" for wood framing.
      2. Division 6 Section "Sheathing" for roof sheathing.
      3. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, counterflashings, flashings and gutters and downspouts.
   C. See Division 1 Section “Alternates” for replacement of shingles at existing building.

1.03 DEFINITION
   A. Roofing Terminology: See ASTM D1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.04 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Samples for Verification: Manufacturer’s full range.
   C. Maintenance Data: For each type of asphalt shingle to include in maintenance manuals.
   D. Warranties: Sample of special warranties.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
      1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
   B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.06 PROJECT CONDITIONS
   A. Environmental Limitations: Do not deliver or install asphalt shingles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC
The system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.07 WARRANTY

A. Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Manufacturing defects.
   b. Structural failures including failure of asphalt shingles to self-seal after a reasonable time

2. Material Warranty Period: 25 years from date of Substantial Completion.
3. Workmanship Warranty Period: 10 years from date of Substantial Completion.

1.08 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Asphalt Shingles: 100 sq. ft of each type, in unbroken bundles.

PART 2 - PRODUCTS

2.01 VAPOR BARRIER

A. 6 mil polyethylene.
   1. Perm rating of 0.5 or less as determined by ASTM E-96

2.02 GLASS-FIBER-REINFORCED ASPHALT SHINGLES


1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. CertainTeed Corporation.
   b. Elk Premium Building Products, Inc.; an ElkCorp company.
   c. GAF Materials Corporation.
   d. Owens Corning.
   e. TAMKO Roofing Products, Inc.

2. Strip Size: Manufacturer's standard.
3. Algae Resistance: Granules treated to resist algae discoloration.
4. Color and Blends: Match existing shingle color and style.

B. Hip and Ridge Shingles: Site-fabricated units cut from asphalt shingle strips. Trim each side of lapped portion of unit to taper approximately 1 inch.
2.03 UNDERLAYMENT MATERIALS


1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Coatings & Waterproofing, Inc.
   c. Henry Company.
   d. Johns Manville.
   e. Owens Corning.
   f. Polyguard Products, Inc.

B. Synthetic Underlayment: Synthetic, scrim-reinforced, water resistant underlayment meeting ASTM D226 and D4869.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. CertainTeed
   b. Or equal approved by addendum prior to accepting bids.

2. Weight: 38# per 4’ x 250’ roll.


2.04 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D4586, Type II, asbestos free.

B. Roofing Nails: ASTM F1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch-diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch-diameter flat head and of sufficient length to penetrate into solid wood decking or extend at least 1/8 inch through OSB or plywood sheathing.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

C. Felt Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch minimum diameter.

2.05 METAL FLASHING AND TRIM

A. General: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."

B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.

C. Vent Pipe Flashings: ASTM B749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches from pipe onto roof.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 VAPOR BARRIER INSTALLATION

A. Install between oriented strand board structural deck and nailbase.

B. Staple or adhere per manufacturer’s recommendation.

3.03 UNDERLAYER INSTALLATION

A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

B. Synthetic Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails.
   1. Install underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of synthetic underlayment over self-adhering sheet underlayment not less than 3 inches in direction to shed water. Lap ends of synthetic underlayment not less than 6 inches in direction to shed water. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.
   2. Install fasteners at no more than 36-inch o.c.

C. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below, lapped in direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.
   1. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
   2. Eaves: Extend from edges of eaves 36 inches beyond interior face of exterior wall.
   3. Rakes: Extend from edges of rake 36 inches beyond interior face of exterior wall.
   4. Valleys: Extend from lowest to highest point 18 inches on each side.
   5. Hips: Extend 18 inches on each side.
   6. Ridges: Extend 36 inches on each side without obstructing continuous ridge vent slot.
   7. Sidewalls: Extend beyond sidewall 18 inches, and return vertically against sidewall not less than 4 inches.
8. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend beyond penetrating element 18 inches, and return vertically against penetrating element not less than 4 inches.
9. Roof Slope Transitions: Extend 18 inches on each roof slope.

3.04 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."

   1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.

C. Step Flashings: Install with a headlap of 2 inches and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.

D. Cricket and Backer Flashings: Install against the roof-penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.

E. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.05 ASPHALT SHINGLE INSTALLATION


B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.

   1. Extend asphalt shingles 3/4 inch over fasciae at eaves and rakes.
   2. Install starter strip along rake edge.

C. Install first and remaining courses of asphalt shingles stair stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Fasten asphalt shingle strips with a minimum of six roofing nails located according to manufacturer's written instructions.

   1. Where roof slope exceeds 20:12, seal asphalt shingles with asphalt roofing cement spots.
   2. Where roof slope is less than 4:12, seal asphalt shingles with asphalt roofing cement spots.
   3. When ambient temperature during installation is below 50 deg F, seal asphalt shingles with asphalt roofing cement spots.

E. Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips. Maintain uniform width of exposed open valley from highest to lowest point.

   1. Set valley edge of asphalt shingles in a 3-inch-wide bed of asphalt roofing cement.
   2. Do not nail asphalt shingles to metal open-valley flashings.
F. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.

G. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.

1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION 07 31 10
SECTION 07 62 00 - FLASHING AND TRIM

PART 1 - GENERAL

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

1.02 SUMMARY
   A. The Work Includes but is not limited to:
      1. Rubberized asphalt flashing.
   B. Related Sections:
      1. Division 4 Section “Unit Masonry Assemblies”.
      2. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.

1.03 PERFORMANCE REQUIREMENTS
   A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads,
      structural movement, thermally induced movement, and exposure to weather without failure
      due to defective manufacture, fabrication, installation, or other defects in construction. Completed
      sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
   B. Fabricate and install roof edge flashing and copings capable of resisting the following forces
      according to recommendations in FMG Loss Prevention Data Sheet 1-49:
      1. Classification of Building: Category III.
      2. Exposure of Building: Category C.
      4. Wind Pressures: Not less than 30 psf; System 2.
   C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal
      movements from ambient and surface temperature changes.
      1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.04 SUBMITTALS
   A. Product Data: For each type of product indicated. Include construction details, material
      descriptions, dimensions of individual components and profiles, and finishes for each
      manufactured product and accessory.
   B. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory
      indicated with factory-applied color finishes involving color selection.

1.05 QUALITY ASSURANCE
   A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet
      metal flashing and trim similar to that required for this Project and whose products have a
      record of successful in-service performance.
B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA’s "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

PART 2 - PRODUCTS

2.01 SHEET METALS
A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
   1. Color: As selected by Architect from manufacturer's full range.
   2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.02 RUBBERIZED-ASPHALT FLASHING
A. Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.
   1. Products: Subject to compliance with requirements, provide one of the following:

2.03 MISCELLANEOUS MATERIALS
A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 CLEANING AND PROTECTION
   
   A. Clean exposed surfaces.

END OF SECTION 07 62 00
1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY
A. Section Includes:
   1. Joint sealants.

B. Provide joint sealants at all locations indicated on the drawings and additionally including but not limited to:
   1. Interface of dis-similar materials i.e. Masonry and gypsum board.
   2. Inside corners of all CMU interior walls.
   3. Perimeter of casework.
   4. Perimeter of hollow metal frames.
   5. Perimeter of aluminum frames.
   6. Where required as smoke seal.

C. Provide sealants at all rated corridor locations.

D. Related Sections:
   1. Division 4 Section "Unit Masonry Assemblies".

1.03 PRECONSTRUCTION TESTING
A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates.

1.04 SUBMITTALS
A. Product Data: For each joint-sealant product indicated or recommended by sealant manufacturer.

   1. Provide manufacturer’s recommended product for sealants at (1) hour rated corridor conditions.

B. Sealant Manufacturer’s recommended products: Provide itemized list of manufacturer’s recommended products for each condition listed above 1.02 / B.

   1. Note special condition: Architectural Precast Concrete does not include any surface sealer. Any sealant that comes in contact with the APC must be non-staining and otherwise compatible with this material.

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Warranties: Sample of special warranties.
1.05 QUALITY ASSURANCE
A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
C. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
   2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.06 PROJECT CONDITIONS
A. Do not proceed with installation of joint sealants unless the following is satisfied.
   1. Follow all manufacturer’s recommendations and guidelines for installation.
   2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   3. When joint substrates are wet.
   4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY
A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.
B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS
2.01 MATERIALS, GENERAL
A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.
   1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food; provide products that comply with 21 CFR 177.2600.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 JOINT SEALANTS

A. General
   1. Products: Subject to compliance with requirements, provide a product from one of the following
      a. Dow Corning Corporation.
      b. GE Advanced Materials.
      c. Sika Corporation, Construction Products Division.
      d. Tremco Incorporated.
      e. Pecora Corporation.
      f. BASF Building Systems.
   2. Provide the manufacturer’s recommended product for the actual substrates and conditions.

2.03 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.04 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
   a. Concrete.
   b. Masonry.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
a. Metal.  
b. Glass.  

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.  
2. Do not stretch, twist, puncture, or tear sealant backings.  
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.  
2. Completely fill recesses in each joint configuration.  
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.  
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.  
3. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated.  
4. Provide flush joint profile where indicated per Figure 8B in ASTM C1193.  
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C1193.
a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.04 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as recommended by manufacturer.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 CLEANING

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

3.06 PROTECTION

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

END OF SECTION 07 92 00
SECTION 08 11 00 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes:
   1. Standard hollow metal doors and frames.
   2. Standard hollow metal frames for borrowed-lites.
   3. Fire Rated hollow metal frames.
      a. Vestibule 101, Commons 104, and Corridor 116 shall include fire rated assemblies.
B. Related Sections
   1. Division 4 Section "Unit Masonry Assemblies" for embedding anchors for hollow metal work into masonry construction.
   2. Division 8 Section "Door Hardware" for door hardware for hollow metal doors.
   3. Division 8 Section “Glazing” for glass used in door vision lites and borrowed-lite frames.
   4. Division 9 Sections “Painting” for field painting hollow metal doors and frames.

1.03 DEFINITIONS
A. Minimum Thickness: Minimum thickness of base metal without coatings.
B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.04 SUBMITTALS
A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating and finishes.
B. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
1.05 QUALITY ASSURANCE
A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to NFPA 252.
C. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking. Do not store in a manner that traps excess humidity.

1.07 PROJECT CONDITIONS
A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.08 COORDINATION
A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Amweld Building Products, LLC.
   2. Ceco Door Products; an Assa Abloy Group company.
   3. Curries Company; an Assa Abloy Group company.
   4. Steelcraft; an Ingersoll-Rand company.
   5. Metal Products, Inc.

2.02 MATERIALS
A. Cold-Rolled Steel Sheet: ASTM A1008, Commercial Steel (CS), Type B; suitable for exposed applications.
B. Hot-Rolled Steel Sheet: ASTM A1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
C. Metallic-Coated (Galvanized) Steel Sheet:  ASTM A653, Commercial Steel (CS), Type B; with minimum G90 metallic coating.

D. Frame Anchors:  ASTM A591, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A1008 or ASTM A1011, hot-dip galvanized according to ASTM A153, Class B.

E. Inserts, Bolts, and Fasteners:  Hot-dip galvanized according to ASTM A153.

F. Grout:  ASTM C476, except with a maximum slump of 4 inches, as measured according to ASTM C143.

G. Mineral-Fiber Insulation:  ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

H. Glazing:  Comply with requirements in Division 8 Section "Glazing."

I. Bituminous Coating:  Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.  Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.03 STANDARD HOLLOW METAL DOORS

A. General:  Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated.  Comply with ANSI/SDI A250.8.

   1. Design:  Flush panel.
   2. Core Construction:  Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
      a. Fire Door Core:  As required to provide fire-protection ratings indicated.
      b. Thermal-Rated (Insulated) Doors:  At all exterior doors, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
         1) Locations:  Exterior doors.
   4. Top and Bottom Edges:  Closed with flush or inverted 0.042-inch-thick, end closures or channels of same material as face sheets.

B. Exterior Doors:  Face sheets fabricated from metallic-coated steel sheet.  Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

   1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).

C. Interior Doors:  Face sheets fabricated from cold-rolled steel sheet, unless metallic-coated sheet is indicated.  Provide doors complying with requirements indicated below by
referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.04 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Interior Frames: Fabricated from cold-rolled steel sheet, unless metallic-coated sheet is indicated.
   1. Fabricate frames with mitered or coped corners.
   2. Fabricate frames as full profile welded.
   3. Frames for Wood Doors: 0.053-inch-thick steel sheet.

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.05 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long.
   2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
   3. Postinstalled Expansion Type for Existing Masonry Construction: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
   1. Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.06 STOPS AND MOLDINGS

A. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

B. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.07 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.
B. Rubber Door Silencers: Except at weather-stripped doors, drill stop in strike jamb to receive three (3) rubber silencers on single door frames. Drill head stop to receive 4 rubber silencers on double door frames. Provide plastic plugs within holes to keep silencer holes clear during construction.

2.08 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:
   1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   2. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
   2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   4. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors as follows:
         1) Two (2) anchors per jamb up to 60 inches high.
         2) Three (3) anchors per jamb from 60 to 90 inches high.
         3) Four (4) anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
      b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Three anchors per jamb up to 60 inches high.
         2) Four anchors per jamb from 60 to 90 inches high.
         3) Five anchors per jamb from 90 to 96 inches high.
         4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
         5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
      c. Compression Type: Not less than two anchors in each jamb.
   5. Door Silencers: Drill stops to receive door silencers as follows. Keep holes clear during construction.
a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.09 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

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

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

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

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

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.


4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

5. In-Place Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.


7. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

   1. Non-Fire-Rated Standard Steel Doors:
      a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
      b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
      c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.

   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
SECTION 08 21 10 - FLUSH WOOD DOORS

PART 1 - GENERAL

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

1.02 SUMMARY
A. The Work includes but is not limited to:
   1. Solid-Core Doors with Wood-Veneer Faces.
   2. Fire Rated Solid-Core Doors with Wood-Veneer Faces.
      a. Vestibule 101, Commons 104, and Corridor 116 shall include fire rated assemblies.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.
   4. Field finishing flush wood doors.
   5. For use at interior locations.

1.03 SUBMITTALS
A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings.
B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
C. Samples for Initial Selection: For factory-finished doors.
D. Warranty: Sample of special warranty.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
B. Source Limitations: Obtain flush wood doors from single manufacturer.
C. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1.05 DELIVERY, STORAGE, AND HANDLING
A. Comply with requirements of referenced standard and manufacturer's written instructions.
B. Package doors individually in plastic bags or cardboard cartons.
C. Mark each door on top rail with opening number used on Shop Drawings.
1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:
      a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
      b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Algoma Hardwoods, Inc.
   2. Buell Door Company Inc.
   3. Eggers Industries.
   4. Graham; an Assa Abloy Group company.
   5. Marshfield Door Systems, Inc.

2.02 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

C. Particleboard-Core Doors:

   1. Particleboard: Straw-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.
   2. Blocking: Provide wood blocking in particleboard-core doors.

2.03 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

   1. Grade: Custom (Grade A faces).
   2. Species: Red Oak
   3. Cut: Plain sliced (flat sliced).
   5. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.

2.04 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
C. Particleboard-Core Doors:
   1. Particleboard: Straw-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.
   2. Blocking: Provide wood blocking in particleboard-core doors as follows:
      a. 5-inch top-rail blocking, in doors indicated to have closers.
      b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
      c. 5-inch midrail blocking, in doors indicated to have exit devices.

2.05 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:
   1. Grade: Custom (Grade A faces).
   2. Species: MATCH ADJACENT OFFICE ENTRY DOOR
   3. Cut: Plain sliced (flat sliced).
   5. Assembly of Veneer Leaves on Door Faces: Running match.
   7. Core: Particleboard.
   8. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.

2.06 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

   1. Comply with requirements in NFPA 80 for fire-rated doors, where indicated in the Drawings.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

   1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Cut and trim openings through doors in factory.

   1. Light Openings: Trim openings with moldings of material and manufacturer’s standard profile.
   2. Glazing: Factory install glazing in doors indicated to be factory finished.

2.07 SHOP PRIMING

A. Doors for Transparent Finish: Prime doors with stain (if required), other required pretreatments. Seal all four edges, edges of cutouts, and mortises with first coat of finish.

2.08 FINISH

A. Provide field finish.
PART 3 - EXECUTION

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

3.02 INSTALLATION
   A. Hardware: For installation, see Division 8 Section "Door Hardware."
   B. Installation Instructions: Install doors to comply with manufacturer's written instructions
      and the referenced quality standard, and as indicated.
      1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
   C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as
      indicated below; do not trim stiles and rails in excess of limits set by manufacturer or
      permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges
      of cutouts, and mortises after fitting and machining.
      1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide
         1/8 inch from bottom of door to top of decorative floor finish or covering unless
         otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch
         from bottom of door to top of threshold unless otherwise indicated.
         a. Comply with NFPA 80 for fire-rated doors.
      2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
      3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to
         extent permitted by labeling agency.
   D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.03 ADJUSTING
   A. Operation: Rehang or replace doors that do not swing or operate freely.
   B. Finished Doors: Replace doors that are damaged or that do not comply with
      requirements. Doors may be repaired or refinished if work complies with requirements
      and shows no evidence of repair or refinishing.

END OF SECTION 08 21 10
SECTION 08 41 10 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section Includes:
      1. Exterior and interior entrance doors, doorframe units and storefront framing including factory glazing.
   B. The Work includes:
      1. Replacement of aluminum storefront doors at openings 100A and 100B.
      2. New openings 101A and 101B. These openings must be rated for (1) hour corridor.
   C. See Sections:
      1. Division 7 Section "Joint Sealants".
      2. Division 8 Section “Door Hardware”.

1.03 DEFINITIONS
   A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.04 PERFORMANCE REQUIREMENTS
   A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
      1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
      2. Dimensional tolerances of building frame and other adjacent construction.
      3. Failure includes the following:
         a. Noise or vibration created by wind and by thermal and structural movements.
         b. Loosening or weakening of fasteners, attachments, and other components.
         c. Sealant failure.
         d. Failure of operating units.
   B. Structural Loads:
      1. Wind Loads: See Designated Design.
   C. Deflection of Framing Members:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed $L/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch, whichever is less.

2. Deflection Parallel to Glazing Plane: Limited to $L/360$ of clear span or $1/8$ inch, whichever is smaller.

D. With doors closed and locked, test in accordance with ASTM E283 at static air pressure difference of $1.57$ psf

1. Air infiltration shall not exceed $0.50$ cfm/sf of unit for single doors.
2. Air infiltration shall not exceed $0.10$ cfm/sf for a pair of doors.

E. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of $20$ percent of positive wind-load design pressure, but not less than $6.24$ lbf/sq. ft.

F. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): $120$ deg F, ambient; $180$ deg F, material surfaces.
2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
   a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of $180$ deg F.
   b. Low Exterior Ambient-Air Temperature: $0$ deg F.
3. Interior Ambient-Air Temperature: $72$ deg F.

G. Condensation Resistance:

1. With doors closed and locked, test in accordance with AAMA 1503.1.
2. Condensation Resistance Factor shall not be less than $40$ (frame) and $52$ (glass) when glazed with $1$" insulated glass.

H. Thermal Transmittance:

1. With doors closed and locked, test in accordance with AAMA 1503.1.
2. U-value shall not be more than:
   a. Glass to exterior: $0.47$ (low-e) BTU/hr/ft$^2$/°F.
   b. Glass to interior: $0.41$ (low-e) BTU/hr/ft$^2$/°F.
   c. Thermal transmittance and condensation resistance performance results are based upon $1"$ clear insulating glass ($1/4"$ clear with $e=0.035$ low e coating on #2 surface, $1/2"$ as with warm edge spacer and $90\%$ argon gas fill, $1/4"$ clear).

I. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by aluminum-framed systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no
   sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not
   separate from each substrate because sealant-to-substrate bond strength exceeds
   sealant's internal strength.

1.05 SUBMITTALS
A. Product Data: For each type of product indicated. Include construction details, material
   descriptions, dimensions of individual components and profiles, and finishes for
   aluminum-framed systems.
B. Designated Design: Wind Speed, provide manufacturer’s calculations indicating wind
   speed requirements based on building height and exposure.
C. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections,
   details, and attachments to other work.
   1. Include details of provisions for system expansion and contraction and for drainage
      of moisture in the system to the exterior.
   2. For entrance doors, include hardware schedule and indicate operating hardware
      types, functions, quantities, and locations.
D. Samples for Initial Selection: For units with factory-applied color finishes.
E. Entrance Door Hardware Submittal:
   1. Prepared by or under the supervision of supplier, detailing fabrication and
      assembly of entrance door hardware, as well as procedures and diagrams.
      Coordinate final entrance door hardware schedule with doors, frames, and related
      work to ensure proper size, thickness, hand, function, and finish of entrance door
      hardware.
F. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.06 QUALITY ASSURANCE
A. Installer Qualifications: Manufacturer's authorized representative who is trained and
   approved for installation of units required for this Project which has had successful
   experience with installation of the same or similar units required for the project and other
   projects of similar size and scope..
B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop
   Drawings, based on testing and engineering analysis of manufacturer's standard units in
   systems similar to those indicated for this Project.
C. Product Options: Information on Drawings and in Specifications establishes
   requirements for systems' aesthetic effects and performance characteristics. Aesthetic
   effects are indicated by dimensions, arrangements, alignment, and profiles of components
   and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   Performance characteristics are indicated by criteria subject to verification by one or
   more methods including preconstruction testing, field-testing, and in-service
   performance.
   1. Do not revise intended aesthetic effects, as judged solely by Architect, except with
      Architect's approval. If revisions are proposed, submit comprehensive explanatory
      data to Architect for review.

E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.


1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration caused by thermal movements.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   d. Adhesive or cohesive sealant failures.
   e. Water leakage through fixed glazing and framing areas.
   f. Failure of operating components.

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Framing series: Trifab 451 (NOT Thermally broken)
   b. System Dimensions: 2” x 4 ½” nominal.

2. EFCO Corporation.

3. Tubelite.

4. Other manufacturer approved by addendum prior to the receipt of bids.

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.


2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.


5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A36.
2. Cold-Rolled Sheet and Strip: ASTM A1008.

C. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8 mm) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

D. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum framing members, trim hardware, anchors, and other components.

E. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

F. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

G. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

H. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.03 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. General:
   a. All exposed work shall be carefully matched to produce continuity of line and design with all joints.
   b. System design shall be such that raw edges will not be visible at joints.


1. Provide system substantially similar to Kawneer IsoLock™ Thermal Break with a 1/4" (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
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2. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.
   3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

E. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action

F. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123 or ASTM A 153.

G. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

I. Glazing Plane: Front.

2.04 GLAZING SYSTEMS

A. See Division 08 Section “Glazing”.

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glass:
   1. Insulated glass shall be 1" consisting of 1/4" exterior, 1/2" air spacer, and 1/4" interior.
   2. Dissimilar Metals:
      a. All dissimilar metals must be properly insulated to prevent galvanic action.
   3. Thermal Barrier:
      a. Barrier material shall be poured in place, two-part polyurethane.
      b. A nonstructural thermal barrier is unacceptable.

F. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
   1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.

2.05 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 2-inch overall thickness, with minimum 0.188-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

2. Door Design: As indicated in the Drawings (Sheet A501).
   a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

   a. Provide nonremovable glazing stops on outside of door.

B. Basis of Design Kawneer 500T wide stile thermal entrance for exterior doors, 500 wide stile non-thermal for interior doors.
   1. Doors shall be provided by the same manufacturer as the storefront. Match performance of basis of bid product.

2.06 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, and finish or color indicated, and otherwise as required for a fully operational and weather tight system.
   a. See 08710 Section “Door Hardware” for additional requirements.

2. Opening-Force Requirements:
   a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.

2.07 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.
2.08 FABRICATION

A. Form or extrude aluminum shapes before finishing.
B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   4. Physical and thermal isolation of glazing from framing members.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
D. Storefront Framing: Fabricate components for assembly using shear-block system or screw-spline system.
E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At exterior doors, provide compression weather stripping at fixed stops.
   2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.
G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.09 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
B. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Color: Selected from manufacturer’s standards.
2.10 EXAMINATION
   A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

2.11 INSTALLATION
   A. General:
      1. Comply with manufacturer's written instructions.
      2. Do not install damaged components.
      3. Fit joints to produce hairline joints free of burrs and distortion.
      4. Rigidly secure nonmovement joints.
      5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
      6. Seal joints watertight unless otherwise indicated.

   B. Metal Protection:
      1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
      2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

   C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

   D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" to produce weathertight installation.

   E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

   F. Install glazing as recommended by Aluminum Entrance manufacturer.

   G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
      1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
      2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

   H. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" to produce weathertight installation and as recommended by Aluminum Entrance manufacturer.

2.12 ERECTION TOLERANCES
   A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
      1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
      2. Alignment:
a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

2.13 FIELD QUALITY CONTROL

A. Inspection.

1. Provide notarized letter from Aluminum Entrance manufacturer stating that manufacturer’s representative has inspected the finished installation, and that the installation and operation meet or exceed all of the manufacturer’s guidelines and recommendations.

B. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

2.14 ADJUSTING, CLEANING AND PROTECTION

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

B. Remove excess sealant, glazing compounds, dirt and other foreign matter from all storefront surfaces.

C. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and installer to insure storefront system is without damage and/or deterioration at the time of Substantial Completion.

END OF SECTION 08 41 10
PART 1 - GENERAL

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

1.02 SUMMARY
A. This Section includes fixed and operable aluminum-framed windows for exterior locations indicated on the Drawings.
B. Note: All new windows shall have integral operable blinds.
C. Related Sections include the following:
   1. Division 6 Section “Rough Carpentry” for blocking, nailers and grounds.
   2. Division 7 Section “Joint Sealants” for sealing around perimeter of installed window units.
   3. Division 8 Section “Glazing” for additional glass requirements.
      a. Note security glazing requirement.
D. See Specification Section 01 10 00 Alternate Bids for replacement of existing windows.

1.03 DEFINITIONS
A. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:
   1. HC: Heavy Commercial with factory glazing.
B. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:
   1. Design pressure number in pounds force per square foot used to determine the structural test pressure and water test pressure.
C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
D. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.04 PERFORMANCE REQUIREMENTS
A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:
   1. Thermal test unit size shall be 48” x 72” consisting of a fixed over projected window.
   2. Air, water, and structural test unit shall conform to requirements set forth in AAMA/NWWDA 101/I.S.2 -97 and manufacturer’s standard locking/operating hardware and insulating glazing configuration.
B. Structural Loads:
   1. Wind Loads: See Designated Design.
C. Air Infiltration Test:
   1. With ventilators closed and locked, test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf.
   2. Air infiltration shall not exceed 0.10 cfm/SF of unit.

D. Water Resistance Test:
   1. With ventilators closed and locked, test unit in accordance with ASTM E 331/ASTM E 547 at a static air pressure difference of 12 psf.
   2. No uncontrolled water leakage.

E. Condensation Resistance Test:
   1. With ventilators closed and locked, test unit in accordance with AAMA 1503.1.
   2. Condensation Resistance Factor shall not be less than 61 (frame 65 (glass) when glazed with 1” insulated – 1/4” clear, 1/2” air space. 1/4” clear low E glass.

F. Thermal Transmittance Test:
   1. With ventilators closed and locked, test unit in accordance with AAMA 1503.1.
   2. U-Factor not more than .48 BTU/hr/sf/°F per AAMA 507 or NFRC 100 when using project specified glass.

G. Thermal Barrier Tests: Testing shall be in general accordance with AAMA 505 Dry Shrinkage and Composite Thermal Cycling test procedure, AAMA TIR-A8, Structural Performance of Composite Thermal Barrier systems.

1.05 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. Designated Design: Wind Speed, provide manufacturer’s calculations indicating wind speed requirements based on building height and exposure.

C. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:
   1. Flashing and drainage details.
   2. Weather-stripping details.
   4. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

D. Samples for Initial Selection: For units with factory-applied color finishes.
   1. Include similar Samples of hardware and accessories involving color selection.

E. Product Test Reports.

F. Maintenance Data to include in maintenance manuals.

G. Warranty: Special warranty specified in this Section.
1.06 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project which has had successful experiences with installation of the same or similar units required for this project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

D. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:
      a. Failure to meet performance requirements.
      b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
      c. Faulty operation of movable sash and hardware.
      d. Deterioration of metals, other materials, and metal finishes beyond normal weathering.
      e. Failure of insulating glass.

   2. Warranty Period:
      a. Window: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Aluminum Window, Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

2.02 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, not less than 16,000-psi minimum yield strength, and not less than 0.070-inch thickness at any location for the main frame and sash members.

1. Extruded Aluminum shall be 6063-T3 alloy and tempered.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.

2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.

1. Weather-Stripping Material: Weather strip shall be equal to EFCO Santoprene.

F. Thermal Barrier: All exterior aluminum shall be separated from interior aluminum by a rigid structural thermal barrier.

2.03 GLAZING

A. Glass:

1. Insulated glass shall be 1" consisting of 1/4" exterior, 1/2" air spacer, and 1/4" interior.

2. Glazing System: Glazing method shall be a wet/dry type in accordance with manufacturer’s standards. Exterior glazing shall be silicone back bedding sealant. Interior glazing shall be snap-in type glazing beads with an interior gasket in accordance with AAMA 702 or ASTM C864.

3. Dissimilar Metals:
   a. All dissimilar metals must be properly insulated to prevent galvanic action.
2.04 HARDWARE
A. General: Provide manufacturer's standard hardware.

2.05 FABRICATION
A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
B. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
C. Sub frames: Provide sub frames with anchors for window units as shown, of profile and dimensions indicated but not less than 0.093-inch (2.4 mm) thick extruded aluminum. Miter or cope corners, and join with concealed mechanical joint fasteners. Finish to match window units. Provide sub frames capable of withstanding design loads of window units.
D. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
E. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
   1. Provide thermal barriers tested according to AAMA 505; determine the allowable design shear flow per the appendix in AAMA 505.
   2. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.
F. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
G. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
H. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with AAMA/WDMA 101/I.S.2/NAFS.
I. Glazing Stops: Provide glazing stops to match sash and ventilator frames.

2.06 FINISHES, GENERAL
A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
2.07 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Color: To be selected from Manufacturer’s standards.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.03 FIELD QUALITY CONTROL

A. Inspection.
   1. Provide notarized letter from Aluminum Window manufacturer stating that manufacturer’s representative has inspected the finished installation, and that the installation and operation meet or exceed all of the manufacturer’s guidelines and recommendations.

B. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

C. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.
D. Prepare test and inspection reports.

3.04 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

E. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08 52 00
PART 1 - GENERAL

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

1.2 SUMMARY
A. Section includes:
   1. Mechanical and electrified door hardware for:
      a. Swinging doors.
   2. Electronic access control system components.
B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:
   1. Cabinets (casework), including locks in cabinets
C. Related Sections:
   1. Division 06 Section “Rough Carpentry”
   2. Division 08 Section “Steel Doors and Frames”
   3. Division 08 Section “Wood Doors”
   4. Division 08 Section “Aluminum Framed Entrances and Storefronts”
   5. Division 26 sections for connections to electrical power system and for low-voltage wiring.
   6. Division 28 sections for coordination with other components of electronic access control system.

1.3 REFERENCES
A. UL - Underwriters Laboratories
   1. UL 305 - Panic Hardware
B. DHI - Door and Hardware Institute
   1. Sequence and Format for the Hardware Schedule
   2. Recommended Locations for Builders Hardware
   3. Key Systems and Nomenclature
C. ANSI - American National Standards Institute
   1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.4 SUBMITTALS
A. General:
   1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.

B. Action Submittals:

1. Product Data: Product data including manufacturers’ technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

2. 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.

3. Door Hardware Schedule: 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.

4. Key Schedule:
   a. 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

C. Informational Submittals:

1. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Name, address, and phone number of local representative for each manufacturer.
   d. Parts list for each product.
   e. Final approved hardware schedule, edited to reflect conditions as-installed.
   f. Final keying schedule
   g. Copies of floor plans with keying nomenclature
   h. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
   i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.5 QUALITY ASSURANCE

A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
1. 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.)
   a. Where no additional products or manufacturers are listed in product category, requirements for “No Substitute” govern product selection.

2. Where products indicate “acceptable manufacturers” or “acceptable manufacturers and products”, provide product from specified manufacturers, subject to compliance with specified requirements and “Single Source Responsibility” requirements stated herein.

B. 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.

C. 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.

D. Single Source Responsibility: Obtain each type of door hardware (locksets, exit devices, closers, etc) from single manufacturer.

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

F. Means of Egress Doors: Latches do not require more than 15 lbf to release latch. Locks do not require use of key, tool, or special knowledge for operation.

G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist.
   2. Maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
      b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
      c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
   3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
   4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches from latch, measured to leading edge of door.

H. Coordination Conferences:
   1. 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
   1. Deliver each article of hardware in manufacturer’s original packaging.

C. Project Conditions:
   1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
   2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:
   1. Promptly replace products damaged during shipping.
   2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
   3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.7 COORDINATION
A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, including access control and keying, with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Direct shipments not permitted, unless approved by Contractor.

1.8 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.
   1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
      a. Closers:
         1) Mechanical: 10 years.
      b. Automatic Operators: 1 year.
      c. Exit Devices:
         1) Mechanical: 3 years.
2) Electrified: 1 year.
d. Locksets:
   1) Mechanical: 3 years.
e. Continuous Hinges: Lifetime warranty
f. Key Blanks: Lifetime

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
B. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.
C. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS
A. Fasteners
   1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
   2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
   3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
   4. Install hardware with fasteners provided by hardware manufacturer.
B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
   1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.3 HINGES
A. Provide five-knuckle, ball bearing hinges.
   1. Manufacturers and Products:
      a. Scheduled Manufacturer and Product: Ives 5BB series
      b. Acceptable Manufacturers and Products: Hager BB series, Bommer BB5000
B. Requirements:
   1. Provide three hinges per door leaf for doors 90 inches or less in height, and one additional hinge for each 30 inches of additional door height.
   2. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
   3. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
      a. Steel Hinges: Steel pins
      b. Non-Ferrous Hinges: Stainless steel pins
      c. Out-Swinging Exterior Doors: Non-removable pins
      d. Out-Swinging Interior Lockable Doors: Non-removable pins
      e. Interior Non-lockable Doors: Non-rising pins

2.4 CONTINUOUS HINGES
   A. Aluminum Geared
      1. Manufacturers:
         a. Scheduled Manufacturer: Ives.
      2. Requirements:
         a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.25, Grade 2.

2.5 ELECTRIC POWER TRANSFER
   A. Manufacturers:
      a. Scheduled Manufacturer: Von Duprin
      b. Acceptable Manufacturers: Securitron, ABH
   B. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.
   C. Locate electric power transfer per manufacturer’s template and UL requirements, unless interference with operation of door or other hardware items.

2.6 FLUSH BOLTS
   A. Manufacturers:
      1. Scheduled Manufacturer: Ives
      2. Acceptable Manufacturers: Rockwood, Trimco
   B. Requirements:
      1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch steel or brass rods at doors up to 90 inches in height. For doors over 90 inches in height increase top rods by 6 inches for each additional 6 inches of door height. Provide dust-proof strikes at each bottom flush bolt.

2.7 MORTISE LOCKS
   Manufacturers and Products:
Scheduled Manufacturer and Product: Schlage L9000 series
Acceptable Manufacturers and Products: No Substitution

Requirements:
Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to “KEYING” article, herein.

Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.

Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
Verify lock functions with owner prior to ordering.

Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

Lever Design: Schlage 17A.

2.8 AUXILIARY LOCKS

A. Deadbolts:

1. Manufacturers and Products:
   a. Scheduled Manufacturer and Product: Schlage B600 series

2. Requirements:
   a. Provide deadbolt series conforming to ANSI/BHMA A156 and function as specified. Cylinders: Refer to “KEYING” article, herein.
   b. Provide deadbolts with standard 2-3/4 inches (70 mm) backset. Provide 2-3/8 inches (60 mm) where noted or if door or frame detail requires. Provide deadbolt with full 1 inch (25 mm) throw, constructed of steel alloy.
   c. Provide manufacturer’s standard strike.
   d. Verify deadbolt functions with owner prior to ordering.

2.9 EXIT DEVICES

A. Manufacturer and Product:

1. Scheduled Manufacturer: Von Duprin 99/33 series.

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3-2014 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to “KEYING” article, herein.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Quiet Operation: Incorporate fluid damper or other device that eliminates noise of exit device operation.

4. Touchpad: Extend minimum of one half of door width, but not the full length of exit device rail. Provide end-cap with two-point attachment to door. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. Provide compression springs in devices, latches, and outside trims or controls; tension springs prohibited.

5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrical requirements.

6. Provide exit devices with manufacturer’s approved strikes.

7. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.

8. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.

9. Provide cylinder dogging at non-fire-rated exit devices, unless specified less dogging.

10. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion that is removed by use of a keyed cylinder, which is self-locking when re-installed.

11. Verify exit device functions with owner prior to ordering.

12. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

   a. Lever Style: Match lever style of locksets.
   b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

13. Provide UL labeled fire exit hardware for fire rated openings.

14. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.

15. Provide electrified options as scheduled in the hardware sets.

2.10 POWER SUPPLIES

A. Manufacturers and Products:

   1. Scheduled Manufacturer and Product: Schlage or Von Duprin PS900 series
   2. Acceptable Manufacturers and Products: Precision ELR series, Sargent 3500 series

B. Requirements:

   1. Provide power supplies, recommended and approved by manufacturer of electrified locking component, for operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring power supply.
   2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supply in an enclosure, complete, and requiring 120VAC to fused input.
5. Provide power supply with emergency release terminals, where specified, that allow release of all devices upon activation of fire alarm system complete with fire alarm input for initiating “no delay” exiting mode.

2.11 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: Schlage
2. Acceptable Manufacturers: No Substitute

B. Requirements:

1. Provide cylinders/cores, from the same manufacturer of locksets, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer’s series as indicated. Refer to “KEYING” article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
   a. Cylinder/Core Type: Small Format Interchangeable Core (SFIC)
4. Replaceable Construction Cores.
   a. Provide temporary construction cores replaceable by permanent cores.

2.12 KEYING

A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Provide keying system capable of multiplex masterkeying.
2. Permanent cylinders/cores keyed by the manufacturer according to the following key system.
   a. Keying system as directed by the Owner.
   b. (Great)Grand Master Key System: Cylinders/cores operated by change (day) keys and subsequent masters (including grand/great grand) keys.
3. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
4. Provide keys with the following features:
   a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm).
5. Identification:
   a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication “Keying Systems and Nomenclature” for identification. Blind code marks shall not include actual key cuts.
   b. Identification stamping provisions must be approved by the Architect and Owner.
c. Stamp keys with Owner’s unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with “DO NOT DUPLICATE”.

d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.

e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

6. Quantity: Furnish in the following quantities.

   a. Change (Day) Keys: 3 per cylinder/core.

   b. Permanent Control Keys: 3 (if required).

   c. Master Keys: 6 per master.

   d. Unused balance of key blanks shall be furnished to Owner with the cut keys.

2.13 KEY CONTROL SYSTEM

A. Manufacturers:

   1. Scheduled Manufacturer: Telkee

   2. Acceptable Manufacturers: HPC, Lund

B. Requirements:

   1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

      a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.

      b. Provide hinged-panel type cabinet for wall mounting.

2.14 DOOR CLOSERS

A. Manufacturers and Products:


   2. Acceptable Manufacturers and Products: No Substitute

B. Requirements:

   1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.

   2. Provide door closers with fully hydraulic, full rack and pinion action with aluminum cylinder.


   4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.

   5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.

   6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.

   7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.15 PROTECTION PLATES

A. Manufacturers:
   1. Scheduled Manufacturer: Ives
   2. Acceptable Manufacturers: Rockwood, Trimco

B. Requirements:
   1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch thick, beveled four edges as scheduled. Furnish with countersunk sheet metal screws, finished to match plates.
   2. Adjust width accordingly for other conflicting hardware (astragals, mullions, etc).
   3. Sizes of plates:
      a. Kick Plates: 10 inches high by 1-1/2 inches less width of door on push side of single doors, 1 inch less width of door on push side of pairs
      b. Mop Plates: 4 inches high by 1 inches less width of door on pull side of single and paired doors
      c. Armor Plates: 35 inches high by 1 -1/2 inches less width of door on push side of single doors, 1 inch less width of door on push side of pairs

2.16 DOOR STOPS AND HOLDERS

A. Manufacturers:
   1. Scheduled Manufacturer: Ives
   2. Acceptable Manufacturers: Rockwood, Trimco

B. Provide door stops at each door leaf:
   1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
   2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
   3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.17 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:
   1. Scheduled Manufacturer: Zero
   2. Acceptable Manufacturers: National Guard, Reese, Pemko

B. Requirements:
   1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
   2. Size threshold width for full wall width when frames are recessed.
   3. Cope thresholds at jambs and in front of mullions if thresholds project beyond door faces.
   4. Furnish thresholds with non-ferrous stainless steel screws and lead anchors.
5. Furnish thresholds with slip resistant coating at exterior openings and where moisture is present.
6. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.18 SILENCERS

A. Manufacturers:
   1. Scheduled Manufacturer: Ives
   2. Acceptable Manufacturers: Rockwood, Trimco

B. Requirements:
   1. Provide "push-in" type silencers for hollow metal or wood frames.
   2. Provide one silencer per 30 inches of height on each single frame, and two for each pair frame.
   3. Omit where gasketing is specified.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
   2. Custom Steel Doors and Frames: HMMA 831.

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
   1. Replace construction cores with permanent cores as indicated in keying section.

I. 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.

J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless noted otherwise or approved by Architect.

L. Closer/Holder: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

M. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
   1. Configuration: Provide power supplies for each opening with electrified door hardware.

N. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

O. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

R. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

2.3 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

2.4 CLEANING AND PROTECTION
   A. Clean adjacent surfaces soiled by door hardware installation.
   B. Clean operating items as necessary to restore proper function and finish.
   C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

2.5 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."

2.6 DOOR HARDWARE SCHEDULE
   A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
   B. Hardware Sets:

To be provided by addendum.

END OF SECTION 08 71 00
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Storefront systems.
4. Interior borrowed lites.

B. The Work requires provision of safety glass as noted on the drawings and additional in all locations required by all applicable building codes.

1. The glazing provider shall be responsible for verifying code compliance prior to submitting its bid, and for providing the appropriate system.

C. See Division 1 Section “Alternates” for replacement of existing windows at existing building.

D. The Work includes:

1. **Installation of Security Glazing** in new and existing construction, both single pane and insulated glass units. Openings to be fitted with safety glazing include:
   a. Doors and sidelites at openings 104A and 104B.
   b. Door and sidelite at 102A
   c. Aluminum W1 windows at room A102.

2. Installation of new laminated safety glazing in new H.M. frame and wood doors.

3. Translucent privacy film on the existing window at room 112.
   a. Note: See alternate Bid #1. If alternate is accepted, provide translucent coating on new window.

E. Secure attachment: Provision of security glazing in existing frames shall include installation of glazing stops as recommended by the security glazing manufacturer to eliminate the potential for the glazing to be pushed out of the frame.

1. Include any additional fasteners or operations recommended by the security glazing manufacturer.

1.03 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.04 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

1.05 SUBMITTALS

A. Product data

B. Samples.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Source Limitations for Glass: Obtain all glass from single source from single manufacturer for each glass type.

D. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.08 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.
B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thickness as required to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes protection testing requirements in ASTM E 1996 for Wind Zone indicated in the Indiana Building Code when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.

D. Performance Characteristics:

1. Thermal:
   a. Winter U-factor/U-value: 0.29
   b. Summer U-factor/U-Value: 0.27
   c. Solar Heat Gain Coefficient: 0.39
   d. Shading Coefficient: 0.45
   e. Relative Heat Gain (BTU/hr-sf): 94
   f. Light to solar gain: 1.79

2. Optical:
   a. Visible Light Transmittance: 70%
   b. Visible Light Reflectance (outside): 11%
   c. Visible Light Reflectance (inside): 12%
   d. Total Solar Transmittance: 34%
   e. Total Solar Reflectance (outside): 28%
   f. Ultraviolet Transmittance: 18%

2.02 GLASS PRODUCTS

A. Float Glass: Annealed float glass ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class 1 (clear), Class 2 (tinted) unless otherwise indicated; of kind and condition indicated.
C. Tempered Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear), Class 2 (tinted) unless otherwise indicated; of kind and condition indicated.

D. Laminated Glass: ASTM C1172
   1. Laminated glass shall be .125 tempered, .030 interlayer, .125 tempered.

E. Glass shall be annealed, heat-strengthened or tempered as required by code and additionally as required to meet thermal stress and wind loads

2.01 SECURITY GLASS PRODUCTS

A. Security Glass, comply with:
   1. ASTM F1233.
   2. H.P. White 5-aa1, 5-aa5, and 5-aa10.

B. Laminated glass product comprised of fusion polymer core cladded with annealed or tempered glass.

C. Manufacturer - Basis-of –design product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
   1. Basis-of-Design: School Guard Glass – SG5
   2. Other manufacturer approved by addendum prior to the submittal of quotes.

2.02 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
   1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
   2. Spacer: Manufacturer's standard spacer material and construction.
   3. Desiccant: Molecular sieve or silica gel, or blend of both.

B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.03 TINTS AND COATINGS

A. At all new exterior glazing provide:
   1. PPG:
      a. Solarban 60 on clear low-E #2.
   2. Equivalent product from an alternate manufacturer approved by addendum prior to submittal of bids.

2.04 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.05 FABRICATION OF GLAZING UNITS

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

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.01 PREPARATION

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

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.02 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.03 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 80 00
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SECTION 09 25 00 - GYPSUM BOARD

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Interior gypsum board.
      a. Ceilings, soffits and bulkheads.
      b. Walls.

B. The Work includes: (1) hour rated corridor construction including shaft wall.

C. Related Sections include the following:
   1. Division 6 Section "Rough Carpentry" for wood framing and furring that supports gypsum board.
   2. Division 7 Section "Building Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

1.04 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
PART 2 - PRODUCTS

2.01 STEEL FRAMING FOR WALLS AND PARTITIONS

A. General: Provide steel framing members complying with the following requirements:

1. Component Sizes and Spacings: As indicated but not less that that required to comply with ASTM C754 under the following maximum deflection and lateral loading conditions:
   a. Maximum Deflection: L/240 at 5 lbf per sq. ft.


B. Steel studs and Runners: ASTM C645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16 inch wide minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:

1. Thickness: 20 gage, unless otherwise indicated, or as demonstrated through manufacturer’s certified engineering calculation that 20 gage framing is insufficient at specified lading, increase gage accordingly.

2. Depth: As indicated on drawings (as minimum) or as required based on framing manufacturer’s load tables for interior wall framing.

3. Special Long Leg Runners: 20 gage (minimum), with legs sufficiently long to adequately support studs at top and allow clearance for live load deflection.

C. Steel Rigid Furring Channels: ASTM C645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:

1. Depth: 7/8 inch.

2. Thickness: 0.0179 inch (25 gage), unless otherwise indicated.

D. Accessories: Provide vertical slide clips, attachments angles, and similar accessories required for a complete system and to fully support framing. Provide bridging, blocking and bracing.

E. Blocking: Provide blocking for anchorage and securement of all materials, equipment, fixtures, and similar elements to gypsum board assemblies, walls partitions, and surfaces. Provide wood blocking in accordance with Division 6, where wood blocking is required.

1. For railings, grab bars, upper cabinets, wall hung casework, and other items where similar loading is expected – provide 12 gage galvanized steel sheet x 6 inches wide by stud spacing sized channels with 90 degree flanged ends for attachment to web of framing members; fasten with self-drilling, corrosion-resistant screws, screwed into heavier gage piece; or provide 2 inch by 6 inch wood blocking securely anchored to steel stud framing with additional framing, clips, and/or similar devices.

2. For toilet partitions, and urinal screens, and similar vertically oriented elements – provide vertical 2 inch by 6 inch wood blocking centered on toilet partition and 2 inch by 12 inch wood blocking centered on urinal screen. Provide blocking not less than 6 feet long. Securely anchor to steel stud framing with additional framing, steel clips, steel blocking and/or similar devices.

3. For towel bars, coat racks, door stops, counter tops, wall hung cabinets, projection screens and other items where similar loading is expected – provide 16 gage by 6 inch wide galvanized steel sheet by stud spacing sized with 90 degree flanged ends for attachment to web of framing members; fasten with self-drilling, corrosion-
resistant screws, screwed into heavier gage piece; or provide 2 inch by 6 inch wood blocking securely anchored to steel stud framing with additional framing, clips and/or similar devices.

4. For base and floor supported wall cabinets, toilet accessories, chalkboards, marker boards, tack boards, lockers and other items where similar loading is expected – provide 20 gage by 6 inch wide galvanized steel sheet by stud spacing sized channels with 90 degree flanged ends for attachment to web of framing members; fasten with self-drilling, corrosion-resistant screws, screwed into heavier gage piece; or provide 2 inch by 6 inch wood blocking securely anchored to steel stud framing with additional framing, clips and/or similar devices.

F. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to permanently fasten steel framing, blocking, and furring members securely to substrates involved; complying with recommendations of steel farming and gypsum board manufacturers for applications indicated.

1. Provide not less than #12-14 pan head sheet metal screw into 16 gage steel; not less than #10-16 pan head sheet metal screw into 20 gage steel; not less than #8-18 pan head sheet metal screw into lesser gage steel. Provide number of screws and/or other fasteners required to develop structural capacity of framing and blocking; space fasteners not closer than recommended by steel framing manufacturer.

2.02 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

A. General: Provide components complying with ASTM C754 for materials and sizes, unless otherwise indicated.

B. Post Installed Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion resistant materials, with holes or loops for attaching hanger wires, and with capability to sustain, without failure, a load equal to 3 times that imposed by ceiling construction, as determined from testing complying with ASTM E488 conducted by a qualified independent testing agency.

1. Screw-in anchor.
2. Chemical anchor.
3. Drilled-in anchor.

C. Power Actuated Fasteners in Concrete: Not acceptable.

D. Channels: Cold-rolled steel, 0.05980 inch thickness (minimum) of base (uncoated) metal and 7/16 inch wide flanges, and as follows:

1. Carrying Channels: 1-1/2 inch deep, 475 lb per 1,000 feet, unless otherwise indicated.
2. Finish: G-60 hot-dip galvanized coating complying with ASTM A525 for framing for exterior soffits and where indicated.

E. Steel Studs for Interior Ceilings: ASTM C645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16 inch wide minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and minimum depth as follows:

1. Thickness: 0.0179 inch (20 gage), unless otherwise indicated.
2. Depth: 3-5/8 inches, unless otherwise indicated.
F. Steel Studs for Furring Channels: ASTM C645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16 inch wide minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and minimum depth as follows:
   1. Thickness: 0.0179 inch (25 gage), unless otherwise indicated.
   2. Depth: 3-5/8 inches, unless otherwise indicated.

G. Steel Rigid Furring Channels: ASTM C645, hat shaped, depth 7/8 inch, and minimum thickness of base (uncoated) metal as follows:
   1. Thickness: 0.0179 inch (25 gage), unless otherwise indicated.

2.03 PANELS, GENERAL

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

2.04 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C36 or ASTM C1396, as applicable to type of gypsum board indicated and whichever is more stringent.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. G-P Gypsum.
      c. USG Corporation.

B. Regular Type
   1. Thickness:
   2. Long Edges: Tapered.

C. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
   1. Thickness: 5/8 inch Type “X”.
   2. Long Edges: Tapered.

D. Mold & Moisture Resistant Type: Also meeting ASTMD3273 “Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.”
   1. Thickness: 5/8 inch Type “X”.
   2. Long Edge: Tapered

2.05 SHAFT WALL

A. General: Provide tested (1) hour rated horizontal assembly.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. G-P Gypsum.
c. USG Corporation.

2. Horizontal Membrane / Corridor ceiling:
a. Assembly:
   1) 1” Sheetrock Gypsum Liner Panels
   2) 5/8” sheetrock fire code C Core gypsum panels
   3) USG steel C-H stud spanning at 24” O.C.
   4) USG steel “J” runner.
   5) Finished Joints

2.06 TRIM ACCESSORIES
A. Interior Trim: ASTM C1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. Curved-Edge Cornerbead: With notched or flexible flanges.
      d. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.07 JOINT TREATMENT MATERIALS
A. General: Comply with ASTM C475.
B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Exterior Gypsum Board: As recommended by panel manufacturer.
C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.
   5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
D. Joint Compound for Exterior Applications:
   1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
2.08 AUXILIARY MATERIALS
   A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
   B. Steel Drill Screws: ASTM C1002, unless otherwise indicated.
      1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
   C. Thermal Insulation: As specified in Division 7 Section "Building Insulation."
   D. Vapor Retarder: As specified in Division 7 Section "Building Insulation."

PART 3 - EXECUTION

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

3.02 APPLYING AND FINISHING PANELS, GENERAL
   A. Comply with ASTM C840.
   B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
   C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
   D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
   E. Form control and expansion joints with space between edges of adjoining gypsum panels.
   F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
      1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
      2. Fit gypsum panels around ducts, pipes, and conduits.
      3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.03 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
   3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.04 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

3.05 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Panels that are substrate for tile.
   3. Level 3: Where indicated on Drawings.
   4. Level 4: Where indicated on Drawings
   5. Level 5: At panel surfaces that will be exposed to view, unless otherwise indicated.

E. Mold & Moisture Resistant Gypsum Panels: Finish according to manufacturer's written instructions to achieve a final surface of smoothness and uniformity.
3.06 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 25 00
SECTION 09 31 00 - CERAMIC TILE

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes:
   1. Ceramic body wall tile.
   2. Crack isolation membranes.
   3. Metal Edge finishing strips.
   4. Metal base Cove strips.
   5. Tile Backing Panels.
B. Related Sections:
   1. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.03 DEFINITIONS
A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
B. ANSI A108 Series: ANSI A108.01 through and including ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
C. Module Size: Actual tile size plus joint width indicated.
D. Face Size: Actual tile size, excluding spacer lugs.

1.04 PERFORMANCE REQUIREMENTS.
A. Dynamic Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ANSI A137.1, Section 9.6:
   1. Level Surfaces: Minimum 0.42 Wet.

1.05 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
1.06 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Fracture-Free Warranty: Written warranty, signed by crack suppression membrane manufacturer agreeing to replace ceramic tile that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of ceramic tile due to unusual traffic, vandalism, or abuse. Failures include, but are not limited to, cracks in ceramic tile floors and joints.

1. Warranty Period: Fifteen (15) years from date of Substantial Completion.

C. System Bond Warranty: Written warranty, signed by mortar and grout manufacturer agreeing to replace ceramic tile that has bond failure within specified warranty period. Warranty does not include deterioration or failure of ceramic tile due to unusual traffic, vandalism, or abuse. Failures include, but are not limited to, cracks in ceramic tile floors and joints.

1. Warranty Period: Fifteen (15) years from date of Substantial Completion.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: All products listed in this section are to be installed by installers with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.

1. Installer will perform work in accordance with methods and practices of ANSI 108, 118 and all TCNA installation methods.

2. Trained & qualified installers will perform demolition of existing materials & protect adjacent finishes to remain during demolition.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

1.08 DELIVERY, STORAGE, AND HANDLING

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

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

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

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.
1.09 PROJECT CONDITIONS
   A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.10 EXTRA MATERIALS
   A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
      1. Tile and Trim Units: Furnish quantity of full-size units equal to 5 percent of amount installed for each type, composition, color, pattern, and size indicated.
      2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.01 PRODUCTS, GENERAL
   A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
      1. Provide tile complying with Standard grade requirements unless otherwise indicated.
   B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
   C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.02 TILE PRODUCTS
   A. Tile Type: Ceramic Tile for Walls (CT1)
      1. Basis of Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
         a. Basis of Design – Louisville Tile
            1) Standard Wall
         b. American Olean; Division of Dal-Tile International, Inc.
         c. Daltile; Division of Dal-Tile International, Inc.
      2. Composition: Ceramic.
      4. Finish: Glossy
      5. Tile Color: Warm Grey
      6. Pattern: 1/3 Brick
      7. Grout Color: As selected by Architect from manufacturer's full range.
8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
   Internal and external corners.
   a. Basis of design: Schluter – JOLLY in brushed aluminum or comparable product equal to design.
10. Provide Aluminum cove strip at BASE of wall tile where tile meets flooring surface.
    a. Basis of design: Schluter – DILEX-AHKA in brushed aluminum or comparable product equal to design.

B. Tile Type: Ceramic Tile for Walls (CT2)
1. Basis of Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
   a. Crossville
   b. American Olean; Division of Dal-Tile International, Inc.
   c. Daltile; Division of Dal-Tile International, Inc.
2. Composition: Ceramic.
4. Finish: Glossy
5. Tile Color: As selected from manufacturer’s full range.
7. Grout Color: As selected by Architect from manufacturer's full range.
8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:

A. Internal and external corners. Tile Type: Quarry Tile for floors (QT)
1. Basis of Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
   a. American Olean; Division of Dal-Tile International, Inc.
   b. Daltile; Division of Dal-Tile International, Inc.
2. Composition: Quarry Tile
5. Tile Color: As selected from manufacturer’s standard range.
7. Grout Color: As selected by Architect from manufacturer's full range.
8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
   a. Internal and external corners.
   b. Cove base.
9. Provide ADA approved threshold at transition between dis-similar flooring materials.
2.03 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. C-Cure; C-Cure Board 990.
   b. Custom Building Products; Wonderboard.
   c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
   d. USG Corporation; DUROCK Cement Board.

2. Thickness: 5/8 inch.

2.04 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

2.05 SETTING MATERIALS

A. General: Manufacturer's standard product that complies with ANSI A118.4 modified dry set cement mortar with non-sag, non-slump properties and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

2.06 GROUT MATERIALS

A. Polymer-Modified Tile Grout (Walls): ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Bonsal American; an Oldcastle company.
   b. Bostik, Inc.
   c. C-Cure.
   d. Laticrete International, Inc.
   e. MAPEI Corporation.
   f. TEC; a subsidiary of H. B. Fuller Company.

2. Polymer Type: Acrylic resin in liquid-latex form for addition to prepackaged dry-grout mix.

2.07 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 7 Section "Joint Sealants."

1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
2. Refer to TCNA Handbook, Method EJ171A-G-11 for recommendations on locating and detailing various types of construction joints.
3. Provide soft joint to match grout joint color at all locations where a change in plane occurs.
B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. DAP Inc.; 100 percent Silicone Kitchen and Bath Sealant.
   b. Dow Corning Corporation; Dow Corning 786.
   c. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
   e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
   f. Tremco Incorporated; Tremsil 600 White.

2.08 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

   1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D87.
   2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.09 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
   a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
   b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.03 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

   1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
a. Tile floors in wet areas.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

   1. Porcelain Tile: 3/16 inch.
   2. Glazed Wall Tile: 1/16 inch.

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

   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
   2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

G. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

3.04 TILE BACKING PANEL INSTALLATION

A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-Portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.05 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.
3.06 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

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

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

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

END OF SECTION 09 31 00
SECTION 09 51 10 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

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

1.02 SUMMARY
   A. This Section includes acoustical tile ceiling panels and exposed suspension systems for ceilings.
      1. Provide 2x2 grid in new ceiling locations.
   B. Include any removal and replacement existing ceilings.

1.03 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Samples for Initial Selection: For components with factory-applied color finishes.
   C. Maintenance Data: For finishes to include in maintenance manuals.

1.04 QUALITY ASSURANCE
   A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension
      system through one source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Deliver acoustical panels, suspension system components, and accessories to Project site in
      original, unopened packages and store them in a fully enclosed, conditioned space where they will
      be protected against damage from moisture, humidity, temperature extremes, direct sunlight,
      surface contamination, and other causes.
   B. Before installing acoustical panels, permit them to reach room temperature and a stabilized
      moisture content.
   C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.06 PROJECT CONDITIONS
   A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and
      weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and
      ambient temperature and humidity conditions are maintained at the levels indicated for Project
      when occupied for its intended use.

1.07 EXTRA MATERIALS
   A. Furnish extra materials described below that match products installed and that are packaged with
      protective covering for storage and identified with labels describing contents.
      1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
      2. Suspension System Components: Quantity of each exposed component equal to 2
         percent of quantity installed.
      3. Hold-Down Clips: Equal to 2 percent of quantity installed.
PART 2 - PRODUCTS

2.01 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.02 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Basis-of-Design Product “ACT”: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

   a. Radar.

2. Celotex.

3. Armstrong.


5. CertainTeed, Inc.
   a. Classification: Provide panels complying with ASTM E84 and type, form, pattern as follows:
      i. Type and Form (ACT): Type III, water felted mineral fiber; Form 2, Class A.
   b. Material: Wet-formed mineral fiber.
   d. LR: Not less than 0.85
   e. NRC: 0.55
   f. CAC: 35 min.
   g. Edge/Joint Detail: 15/16” Square Lay-in.
   h. Thickness: 3/4 inch.
   i. Modular Size: 24 by 24 inches.
   j. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.
   k. Fire Rating: Class A

B. Basis-of-Design Product “ACT-M”: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

   a. Radar Ceramic, ClimaPlus.

2. Celotex.

3. Armstrong.

5. CertainTeed, Inc.
   a. Classification: Provide panels complying with ASTM E84 and type, form, pattern as follows:
      i. Type and Form (ACT-M): Type XX, water-felted, ceramic-bonded mineral fiber, Class A.
   d. LR: Not less than 0.82
   e. NRC: 0.50
   f. CAC: min. 40
   g. Edge/Joint Detail: 15/16” Square Lay-in.
   h. Thickness: 3/4 inch.
   i. Modular Size: 24 by 24 inches.
   j. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.
   k. Fire Rating: Class A

2.03 METAL SUSPENSION SYSTEMS, GENERAL
A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C635, Table 1, "Direct Hung," unless otherwise indicated.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A641, Class 1 zinc coating, soft temper.
   2. Stainless-Steel Wire: ASTM A580, Type 304, nonmagnetic.
   4. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.

E. Hanger Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized steel sheet complying with ASTM A653, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

G. Hold-Down Clips (Vestibules): Provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees at Vestibules and within 6’ of any exterior door.

2.04 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING
A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
      a. DX/DXL.
   2. Chicago Metallic Corporation.
   3. Armstrong.
B. Wide-Face, Capped, Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, with prefinished 15/16-inch-wide metal caps on flanges.
   1. Exposed Tee System.
   2. Face Design: Flat, flush.
   5. Painting: Hot-dipped galvanized coating.

2.05 METAL EDGE MOLDINGS AND TRIM
A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with the requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.

PART 3 - EXECUTION
3.01 EXAMINATION
A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION
A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Wherever possible, avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION
A. General: Install acoustical panel ceilings to comply with ASTM C636, and per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or
other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.

8. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

9. Do not attach hangers to steel deck tabs.

10. Do not attach hangers to steel roof deck. Attach hangers to structural members.

11. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:
   a. Install panels with pattern running in one direction parallel to long axis of space.
   b. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
   c. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
   d. Install hold-down clips in areas indicated, as recommended by panel manufacturer's written instructions, unless otherwise indicated.
   e. Install impact clips in areas indicated, as recommended by panel manufacturer's written instructions, unless otherwise indicated.
3.04 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 10
SECTION 09 65 10 - RESILIENT FLOOR TILE AND BASE

PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section Includes:
      1. Vinyl composition floor tile (VCT) with high performance coating.
      2. Rubber cove base and accessories.

1.03 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Samples for Initial Selection: For each type of floor tile indicated.
   C. Maintenance Data: For each type of floor tile to be included in maintenance manuals.

1.04 QUALITY ASSURANCE
   A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
      1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.06 PROJECT CONDITIONS
   A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
      1. 48 hours before installation.
      2. During installation.
      3. 48 hours after installation.
   B. Close spaces to traffic during floor tile installation.
   C. Close spaces to traffic for 48 hours after floor tile installation.
   D. Install floor tile after other finishing operations, including painting, have been completed.
1.07 EXTRA MATERIALS
   A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
      1. Floor Tile: Furnish 1 box of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.01 VINYL COMPOSITION FLOOR TILE (VCT)
   A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
         a. Imperial Texture Standard Excelon with Diamond 10 technology coating.
      2. Other manufacturer IF comparable coating system is available:
         a. Tarkett.
         b. Other manufacturer accepted by addendum prior to submitting the bid.
   B. Tile Standard: ASTM F1066, Class 2, through-pattern tile.
   C. Wearing Surface: Smooth.
   D. Thickness: 0.125 inch.
   E. Size: 12 inches by 12 inches.
   F. Colors and Patterns: As indicated in contract documents.

2.02 RUBBER WALL BASE
   A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
      3. Flexco, Inc.
      4. Roppe Corporation.
      5. VPI, LLC.
   B. Material Requirement: Type TS (rubber, vulcanized thermoset).
   C. Manufacturing Method: Group I (solid, homogeneous).
   D. Style: Cove (base with toe).
   E. Height: 4”.
   F. Thickness: 0.125 inch.
   G. Length: 100’ coils.
   H. Corners: Job Formed.
   I. Color: Selected from manufacturer’s full range of standard colors.

2.03 RESILIENT MOLDING ACCESSORY
   A. Resilient Molding Accessory:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Johnsonite.
   b. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
   c. Flexco, Inc.
   d. R.C.A. Rubber Company (The).
   e. Roppe Corporation, USA.
   f. VPI, LLC; Floor Products Division.

B. Description: Joiner for tile and carpet and Transition strips.

C. Material: Rubber.

D. Colors and Patterns: As selected by Architect from full range of manufacturer’s standard colors.

2.04 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   a. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
   b. Rubber Floor Adhesives: Not more than 60 g/L.

C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are same temperature as space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 FLOOR TILE INSTALLATION
A. Comply with manufacturer's written instructions for installing floor tile.
B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles square with room axis.
C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).
D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.04 RESILIENT BASE INSTALLATION
A. Comply with manufacturer's written instructions for installing resilient base.
B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
E. Do not stretch resilient base during installation.
F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
G. Preformed Corners: Install preformed corners before installing straight pieces.
H. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible.

3.05 RESILIENT ACCESSORY INSTALLATION
A. Comply with manufacturer's written instructions for installing resilient accessories.

3.06 CLEANING AND PROTECTION
A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.
C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
   1. Apply two (2) coats.
E. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products.
   1. Sealer: Apply two (2) base coats of liquid sealer.
   2. Finish: Apply two (2) coats of liquid floor finish.
F. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 10
SECTION 09 68 00 - CARPET TILE

PART 1 - GENERAL

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

1.02 SUMMARY
A. This Section includes carpet tile and walk-off carpet tile, installation, and accessories.
B. Related Sections include the following:
   1. Division 9 Section "Resilient Floor Tile and Base" for resilient wall base and accessories installed with carpet tile.

1.03 SUBMITTALS
A. Product Data: For the following, including installation recommendations for each type of substrate:
   1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet: Full size carpet tile of each type required.
   2. Exposed Edge, Transition, and other Accessories: 12-inch- long samples.
C. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet.
D. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE
A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
B. Carpet Tile Surface Burning Characteristics: Provide carpet tile identical to that tested for the following fire performance characteristics, per test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify carpet tile with appropriate markings of applicable testing and inspecting organization.
   2. Flame Spread: Critical radiant flux to meet Class I when tested by ASTM E648, (glue down).
1.05 DELIVERY, STORAGE, AND HANDLING
   A. Deliver materials to project site in original factory wrappings and containers, labeled with identification of manufacturer, brand name, and lot number.
   B. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity. Lay flat, blocked off ground. Maintain minimum temperature of 68 deg F at least three (3) days prior to and during installation in area where materials are stored.

1.06 PROJECT CONDITIONS
   A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
   B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

1.07 EXTRA MATERIALS
   A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   B. Carpet: Two (2) unopened boxes, plus all opened boxes of each type of carpet tile and walk off carpet tile installed.

1.08 WARRANTY
   A. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

   1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and de-lamination.
   3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 CARPET TILE (CPT):
   A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated as basis of design or comparable product by one of the following:

   1. Basis of Design – Interface
      a. The Standard
      b. Color: Ref. finish schedule.
      c. Lay Pattern: Non-directional
   2. Milliken
3. Mannington
4. Or approved equal prior to submitting bids.
B. Size: 25cm x 1m
C. Backing System: GlasBac Tile
D. Yarn System: 100% Recycled Content Type 6 Nylon
E. Color System: 100% Solution Dyed
F. Construction: Tufted Textured Loop
G. Pile Thickness: .074 in
H. Pile Density: 7,297
I. Recycled Content: 72%
J. Surface Flammability: Pass Methenamine Pill Test (DOC-FF1-70).
K. Flooring Radiant Panel: Class 1 (ASTM E648).
L. Smoke Density: 450 or less (ASTM E662).
M. Electrostatic propensity: 3.0 Kv maximum. (AATCC -134)
N. Applied Soil-Resistance Treatment: Manufacturer's standard material.

2.02 WALK OFF CARPET TILE (WOC)
A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated as basis of design or comparable product by one of the following:
   1. Basis of Design – Interface
      a. Step Repeat Collection: Colorline
      b. Style: SR899
      c. Color: 104939 Granite
      d. Lay pattern: Quarter-Turn
   2. Milliken
   3. Mannington
   4. Or approved equal prior to submitting bids.
B. Size: 50cm x 50cm
C. Backing System: GlasBac Tile
D. Yarn System: 100% Recycled Content Type 6 Nylon; Scrubber Yarn
E. Color System: 100% Solution Dyed
F. Pile Thickness: .143 in.
G. Pile Density: 6,545
H. Recycled Content: 74%
I. Surface Flammability: Pass Methenamine Pill Test (DOC-FF 1-70)
J. Flooring Radiant Panel: Class 1 (ASTM E648).
K. Electrostatic propensity: 3.0 Kv maximum. (AATCC 134).
L. Applied Soil-Resistance Treatment: Manufacturer's standard material.
M. Antimicrobial Treatment: Manufacturer's standard material.

2.02 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.
   1. VOC Limits: Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
   2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.
3.03 INSTALLATION
A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
B. Installation Method: As recommended in writing by carpet tile manufacturer.
C. Maintain dye lot integrity. Do not mix dye lots in same area.
D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
G. Install pattern parallel to walls and borders.

3.04 CLEANING AND PROTECTING
A. Perform the following operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.
B. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."
C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION 09 68 00
PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes surface preparation and the application of paint systems on exterior substrates. Including:
      1. Existing EIFS.
      2. Metal handrails.
      3. Wood.
      5. Exterior portland cement plaster (stucco).
   B. Related Requirements:
      1. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
   C. See Specification Section 01 10 00 Alternate Bids for painting existing EIFS.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product. Include preparation requirements and application instructions.
      1. Indicate VOC content.
   B. Samples for Initial Selection: For each type of topcoat product.
   C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
      1. Submit Samples on rigid backing, 8 inches (200 mm) square.
      2. Label each coat of each Sample.
      3. Label each Sample for location and application area.
   D. Product List: For each product indicated, include the following:
      1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
      2. Indicate VOC content.

1.4 CLOSEOUT SUBMITTALS
   A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.
1.5 MAINTENANCE MATERIAL SUBMITTALS
A. Furnish extra materials from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 5% but not less than two (2) gallons of each material and color applied.

1.6 QUALITY ASSURANCE
A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      b. Other Items: Architect will designate items or areas required.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture’s label with the following information:
   1. Product name and type (description).
   2. Batch date.
   3. Color number.
   4. VOC content.
   5. Environmental handling requirements.
   6. Surface preparation requirements.
   7. Application instructions.
B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS
A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); products indicated or comparable product from one of the following:

1. Sherwin-Williams Company (The).
2. Benjamin Moore & Co.
3. PPG Architectural Finishes, Inc.

B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 016000 "Product Requirements," and the following:

1. Products are approved by manufacturer in writing for application specified.
2. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.

C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.

1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: For field applications, provide paints and coatings that complies with VOC content limits of authorities having jurisdiction.

C. Colors: As selected by Architect from manufacturer's full range.

1. Approximately 10% percent of surface area will be painted with deep tones.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with
rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.

1. Report, in writing, conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   a. Concrete: 12 percent.
   b. Fiber-Cement Board: 12 percent.
   c. Masonry (Clay and CMU): 12 percent.
   d. Wood: 15 percent.
   e. Portland Cement Plaster: 12 percent.
   f. Gypsum Board: 12 percent.

2. Portland Cement Plaster Substrates: Verify that plaster is fully cured.

3. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
I. Aluminum Substrates: Remove loose surface oxidation.
J. Wood Substrates:
1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION
A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed to view:
      a. Equipment, including panelboards and switch gear.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL
   A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
      1. Contractor shall touch up and restore painted surfaces damaged by testing.
      2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION
   A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
   B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
   C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
   D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE,
   A. Concrete, Clay Masonry, Portland Cement Plaster (Stucco), Cementitious Siding, Nontraffic Surfaces:
      1. Latex System:
         a. Prime Coat: Primer sealer, latex.
            1) S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils (0.203 mm) wet, 3.2 mils (0.081 mm) dry.
d. Topcoat: Latex, exterior, low sheen.
   1) S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.

B. Concrete Substrates, Pedestrian Traffic Surfaces:
   1. Latex Floor Paint System:
      a. First Coat: Floor paint, latex, slip-resistant, matching topcoat.
      b. Topcoat: Floor paint, latex, slip-resistant, low gloss.
         1) S-W ArmorSeal Tread-Plex, B90 Series, at 1.5 to 2.0 mils (0.038 to 0.051 mm) dry per coat.
   2. Concrete Stain System (Water-based) for Vertical Surfaces:
      a. First Coat: Low-luster opaque finish matching top coat.
      b. Topcoat: Low-luster opaque finish.
         1) S-W H&C Colortop Water-Based Solid Color Concrete Stain, at 50 to 250 sq. ft. per gal. (1.23 to 6.14 sq. m per liter).

C. CMU Substrates:
   1. Latex System:
      a. Block Filler: Block filler, latex, interior/exterior:
         1) S-W PrepRite Block Filler, B25W25, at 75 to 125 sq. ft. per gal. (1.84 to 3.07 sq. m per liter).
      c. Topcoat: Latex, exterior, low sheen.
         1) S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.

D. Ferrous Metal, Galvanized-Metal, and Aluminum Substrates:
   1. Water-Based Light Industrial Coating System:
         1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, 5.0 to 10.0 mils (0.127 to 0.254 mm) wet, 2.0 to 4.0 mils (0.051 to 0.102 mm) dry.
      c. Topcoat: Light industrial coating, exterior, water based, semi-gloss.
         1) S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils (0.064 to 0.102 mm) dry, per coat.

E. Wood Substrates: Including new and existing exposed wood items not indicated to receive shop-applied finish.
   1. Latex System:
      a. Prime Coat: Primer, latex for exterior wood.
         1) S-W Exterior Latex Primer, B42, at 4.0 mils (0.102 mm) wet, 1.4 mils (0.036 mm) dry, per coat.
      c. Topcoat: Latex, exterior, low-sheen:
1) S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.

F. Plastic Trim Fabrication Substrates: Including architectural PVC, plastic, and fiberglass items.

1. Latex System:
   a. Prime Coat: Primer, bonding, water-based:
      1) S-W PrepRite ProBlock Latex Primer/Sealer, B57-620 Series, at 4.0 mils (0.102 mm) wet, 1.4 mils (0.036 mm) dry.
   c. Topcoat: Latex, exterior, low-sheen:
      1) S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.

G. Exterior Gypsum Board Substrates:

1. Latex System:
      1) S-W PrepRite ProBlock Latex Primer/Sealer, B57-620 Series, at 4.0 mils (0.102 mm) wet, 1.4 mils (0.036 mm) dry.
   c. Topcoat: Latex, exterior, low-sheen:
      1) S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.


1. Prepare existing EIFS per paint manufacturer’s recommendations, and minimally pressure wash.

2. Latex System:
   a. First Coat: Latex, exterior, matching topcoat.
   b. Topcoat: Latex, exterior, low-sheen:
      1) S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.

END OF SECTION 09 91 13
SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Gypsum board.
   2. Miscellaneous metal and wood substrates.
   3. Structural Glazed Tile, see special requirements for preparation.

B. All door frames shall have paint spray applied.

1.03 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523, a matte flat finish.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

   1. Submit Samples on rigid backing, 8 inches square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. VOC content.

1.05 MOCK-UP / SAMPLE PANEL

A. Structural Glazed Tile: Perform preparation of Structural Glazed Tile surface in preparation for installation of primer. Schedule meeting between the Painting Contractor, Paint (primer) Manufacturer’s Representative, and Design Professional to review preparation prior to installation of primer.

B. Allow primer to set and perform adhesion test as recommended by Primer manufacturer prior to installing finish coats.

1.06 CLOSEOUT SUBMITTALS

A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5% percent, but not less than two (2) gallons of each material and color applied.

1.08 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in “MPI Approved Products List.”

2. Preparation and Workmanship: Comply with requirements in “MPI Architectural Painting and Specifications Manual” for products and paint systems indicated.

B. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

   a. Vertical and Horizontal Surfaces: Provide samples of at least 4’x4’.

   b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer’s label with the following information:

1. Product name and type (description).
2. Batch date.
3. Color number.
4. VOC content.
5. Environmental handling requirements.
6. Surface preparation requirements.
7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.10 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

1. If manufacturer’s recommendation is more stringent, follow manufacturer’s recommendation.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. If manufacturer’s recommendation is more stringent, follow manufacturer’s recommendations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company products indicated or comparable product from one of the following:

1. Sherwin-Williams Company (The).
2. Benjamin Moore & Co.
3. Glidden Professional, Division of PPG Architectural Finishes, Inc.
4. PPG Architectural Finishes, Inc.

B. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.02 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 150 g/L.
   3. Dry-Fog Coatings: 400 g/L.
   4. Primers, Sealers, and Undercoaters: 200 g/L.
   5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
   7. Pretreatment Wash Primers: 420 g/L.
   8. Floor Coatings: 100 g/L.
   9. Shellacs, Clear: 730 g/L.
   10. Shellacs, Pigmented: 550 g/L.

C. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Colors: As selected by Architect from manufacturer's full range.
   1. Less than ten percent of surface area will be painted with deep tones.

2.03 PAINT, STRUCTURAL GLAZED TILE

A. Primer: provide Sherwin Williams “Extreme Bond” Interior/exterior bonding primer.
   1. Follow all manufacturer’s recommendations for installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question,
apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.

1. Report, in writing, conditions that may affect application, appearance, or performance of paint.

2. Examine existing coatings for compatibility with new finishes. Verify with manufacturer that new coatings are appropriate. Provide alternate finish if recommended by manufacturer at no additional cost to the contract.

B. Substrate Conditions:

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   a. Masonry (Clay and CMU): 12 percent.
   b. Gypsum Board: 12 percent.
      Note: If manufacturer’s recommendation is more stringent, follow manufacturer’s recommendation.

2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

   1. Beginning coating application constitutes Contractor’s acceptance of substrates and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

G. Aluminum Substrates: Remove loose surface oxidation.
H. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

I. Ceiling Substrates: Do not begin paint application until surfaces are dry.

3.03 PREPARATION, STRUCTURAL GLAZED TILE

A. Follow all paint manufacturer’s recommendations for preparation, and additionally:

1. Wash and remove all surface contamination.
2. Scuff sand or scrub with abrasive cleaner to dull surface.

3.04 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in occupied spaces:
   a. Equipment, including panelboards.
   b. Uninsulated metal piping.
   c. Uninsulated plastic piping.
   d. Pipe hangers and supports.
   e. Metal conduit.
   f. Plastic conduit.
   g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   h. Other items as directed by Architect.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.
3.05 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.06 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.07 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. Water-Based Light Industrial Coating System (Sherwin-Williams basis of design):
   a. Block Filler: Block filler, latex, interior/exterior: S-W PrepRite Block Filler, B25W25, at 100 to 200 sq. ft. per gal.
   c. Topcoat: Light industrial coating, interior, water based, Eg-shell: S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K45 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

B. SGT Substrates:

1. Water-Based Light Industrial Coating System (Sherwin-Williams basis of design):
   a. Block Filler: Block filler, latex, interior/exterior: S-W PrepRite Block Filler, B25W25, at 100 to 200 sq. ft. per gal.
   c. Topcoat: Light industrial coating, interior, water based, Eg-shell: S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K45 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

C. Metal Substrates (Aluminum, Steel, Galvanized Steel):

1. Water-Based Light Industrial Coating System: (Sherwin-Williams basis of design.)
   a. Prime Coat: Primer, rust-inhibitive, water based: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10.0 mils wet, 2.0 to 4.0 mils dry.
c. Topcoat: Light industrial coating, interior, water based, **Semi-gloss**: S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K46-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
d. All door frames shall have paint spray applied.

D. Gypsum Board Substrates & Plaster (walls):
   1. Latex System: (Sherwin-Williams basis of design.)
      c. Horizontal Surfaces & Soffit Topcoat: Latex, interior, flat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
      d. Vertical Surfaces Topcoat: Latex, interior, **Eg-shell**: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

E. Gypsum Board Substrates (ceilings):
   1. Latex System: (Sherwin-Williams basis of design.)
      c. Horizontal Surfaces & Soffit Topcoat: Latex, interior, flat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
         Vertical Surfaces Topcoat: Latex, interior, **Flat**: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

**END OF SECTION 09 91 23**
SECTION 10 10 10 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section Includes:
      1. Factory assembled Markerboards.
      2. Factory assembled Tackboards.

1.03 DEFINITIONS
   A. Tackboard: Framed or unframed, tackable, visual display board assembly.
   B. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.
   C. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

1.04 SUBMITTALS
   A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.
   B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
      1. Show locations of panel joints.
      2. Include sections of typical trim members.
   C. Samples for Initial Selection: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:
      1. Actual sections of porcelain-enamel face sheet assembly.
      2. Actual sections of manufacturer’s plastic-impregnated cork sheet samples.

1.05 QUALITY ASSURANCE
   A. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.
   B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      1. Flame-Spread Index: 25 or less.
      2. Smoke-Developed Index: 450 or less.
1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.
B. Store visual display surfaces vertically with packing materials between each unit.

1.07 PROJECT CONDITIONS
A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
B. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.
   1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.08 WARRANTY
A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Surfaces lose original writing and erasing qualities.
      b. Surfaces exhibit crazing, cracking, or flaking.
   2. Warranty Period: Life of the building.

PART 2 - PRODUCTS
2.01 MATERIALS, GENERAL
A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.
   1. Gloss Finish: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser.
B. Natural Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.
C. Linoleum resilient homogeneous tackable surface material consisting of linseed oil, granulated cork, resin binders and dry pigments, mixed and calendered onto a natural burlap backing.
D. Hardboard: ANSI A135.4, tempered.
E. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.
F. Fiberboard: ASTM C 208.
G. Extruded Aluminum: ASTM B 221, Alloy 6063.
2.02 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch-thick, porcelain-enamel face sheet with low-gloss finish.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Claridge Products and Equipment, Inc.
      c. Or approved equal prior to submitting bids.
   3. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

B. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-thick, extruded aluminum, and as follows:
   1. Manufacturer's standard factory-applied aluminum trim with clear anodic finish.
   2. Corners: Square.

C. Chalktray: Manufacturer's standard, continuous.
   1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

D. Special-Purpose Graphics: Fuse or paint the following graphics into surface of porcelain-enamel visual display unit located in the Music Room B107 (See interior elevation 8/A706):
   1. Music staff lines.

E. Face Sheet Color: White

F. Width: As indicated on Drawings.

G. Height: As indicated on Drawings.

H. Mounting: Wall.

I. Mounting Height: As indicated on Drawings.

2.03 TACKBOARD ASSEMBLIES

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Claridge Products and Equipment, Inc.
      c. Or equal approved by addendum prior to submitting bids.

B. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-thick, extruded aluminum, and as follows:
   1. Manufacturer's standard factory-applied aluminum trim with clear anodic finish.
   2. Corners: Square.

C. Edges: Concealed by trim.
D. Width: As indicated on Drawings.
E. Height: As indicated on Drawings.
F. Mounting: Wall.
G. Mounting Height: As indicated on Drawings.

2.04 FABRICATION
A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
B. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
   1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawing.
   2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.
   3. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.
   4. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
C. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.05 GENERAL FINISH REQUIREMENTS
A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.06 ALUMINUM FINISHES
A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.

C. Examine walls and partitions for proper preparation and backing for visual display surfaces.

D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION
A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

1. Prime wall surfaces indicated to receive visual display wall panels and as recommended in writing by primer/sealer manufacturer and visual display wall panel manufacturer.

3.03 INSTALLATION, GENERAL
A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.04 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES
A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

3.05 CLEANING AND PROTECTION
A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

D. Remove any/all adhesive residue immediately per manufacturer’s written instructions.

END OF SECTION 10 10 10
SECTION 10 26 13 – CORNER GUARDS

PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section Includes:
      1. Protective Wallcovering:
         a. Corner guard for gypsum board walls.
   B. The Work includes:
      1. Flush mount corner guards at exposed outside corners of gypsum board walls as indicated on Drawings.
      2. Flush mount end wall protector at exposed gypsum board walls as indicated on Drawings.
      3. Surface mounted corner guards at exposed outside corners of gypsum board walls as indicated on Drawings.

1.03 SUBMITTALS
   A. Samples for Initial Selection: Verification samples of corner guard, 8” long, in full size profiles of each type and color selected.
   B. Product Data: Manufacturer’s printed product data for each type of corner guard specified.
   C. Manufacturer’s Installation Instruction: Printed installation instructions for each corner guard.

1.04 DELIVERY, STORAGE, AND HANDLING
   A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
      1. Failures include, but are not limited to, the following:
         a. Structural failures.
         b. Deterioration of plastic and other materials beyond normal use.
      2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 CORNER GUARD
   A. Basis-of-Design Product “Flush Mount Corner Guard”: Subject to compliance with requirements, provide basis of bid manufacturer or comparable product by one of the following:
1. IPC Door and Wall Protection Systems, InPro Corporation.
2. Koroseal, “Korogard”
3. Alternate approved by addendum prior to submittal of Quotes.
   a. Product Description:
      1. System: 160F Flush Mount Corner Guard
      2. Dimensions:
         a. Leg Length: 2”x2”
         b. Angle: 90°
         c. Height: 9’-0” (or to ceiling/soffit)
      4. Material: Rigid Vinyl
      5. Color: As selected from manufacturer’s solid color choices.

B. Basis-of-Design Product “Flush Mount End Wall Protector”: Subject to compliance with requirements, provide basis of bid manufacturer or comparable product by one of the following:
1. IPC Door and Wall Protection Systems, InPro Corporation.
2. Koroseal, “Korogard”
3. Alternate approved by addendum prior to submittal of Quotes.
   a. Product Description:
      2. Dimensions:
         a. Leg Length: 2”x2”
         b. Angle: 90°
         c. Height: 9’-0” (or to ceiling/soffit)
      4. Material: Rigid Vinyl
      5. Color: As selected from manufacturer’s solid color choices.

C. Basis-of-Design Product “Surface Mount Corner Guard”: Subject to compliance with requirements, provide basis of bid manufacturer or comparable product by one of the following:
1. IPC Door and Wall Protection Systems, InPro Corporation.
2. Koroseal, “Korogard”
3. Alternate approved by addendum prior to submittal of Quotes.
   a. Product Description:
      1. System: 160F Flush Mount Corner Guard
      2. Dimensions:
a. Leg Length: 1”x1”
b. Angle: 90°.
c. Height: 8’-0”

3. Material: Clear Polycarbonate

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION
   A. Complete finishing operations, including painting.
   B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.03 INSTALLATION
   A. General: Install per manufacturer’s instructions.

3.04 CLEANING
   A. Immediately after completion of installation, clean wall protection and accessories using a standard, ammonia-based, household cleaning agent.
   B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 13
PART 1 - GENERAL

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

1.02 SUMMARY
A. This Section includes the following:
1. Room signage accessible to persons with disabilities.

B. The work includes:
1. Provide (1) room sign for every room named on Sheet A101.
2. Provide (2) additional room signs.
3. Note: Sheet A101 includes room names and numbers as used for construction only, coordinate final room sign text and numbers with the Owner. See sheet A001 for sign format.
5. Project Sign: See sheet A001, detail 2.

1.03 DEFINITIONS

1.04 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Shop Drawings: Show fabrication and installation details for signs.
1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
2. Provide message list, typestyles, and graphic elements, including tactile characters and Braille, and layout for each sign.

1.05 QUALITY ASSURANCE

1.06 WARRANTY
A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
   a. Deterioration of polymer finishes beyond normal weathering.
b. Deterioration of embedded graphic image colors and sign lamination.

2. Warranty Period: Five (5) years from date of Substantial Completion.

**PART 2 - PRODUCTS**

2.01 PANEL SIGNS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, match specifications of Basis of Bid.:

1. ASI – Basis of Bid:
   a. Acrylic.
   b. Solid color selected from manufacturer’s standard range.
   c. Rectangular.
   d. Letter size to meet ADA recommendations, style and color from manufacturer’s standard range.
   e. Install with tape and sealant.

2. ACE Sign Systems, Inc.
4. Or approved equal by the Architect prior to submitting bids.

B. Sign Schedule:

1. Provide signs at the following locations, verify text with Owner prior to fabricating:
   a. Provide (1) sign for each space on the contract documents which has a room name and number.
   b. Final room names and numbers shall NOT be the same as those on the construction documents, coordinate final names and numbers with the design Professional.

2. Sign Text:
   a. NUMBER (3 numbers – Coordinate with Owner)
   b. ROOM IDENTIFICATION (up to 14 characters)
   c. Braille equivalents.

3. Toilet Room Signs:
   a. Provide sign meeting ADA recommendations.

**PART 3 - EXECUTION**

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.02 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions for surface(s) to which sign is to be mounted.

3.03 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.
SECTION 10 52 20 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes:
   1. Fire protection cabinets for installation into new wall construction for the following:
      a. Portable fire extinguishers.
   B. Provide (4) fire extinguisher cabinets to be field located by the local fire official.

1.03 SUBMITTALS
A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1.04 QUALITY ASSURANCE
A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.05 COORDINATION
A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
B. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Cold-Rolled Steel Sheet: ASTM A1008, Commercial Steel (CS), Type B.
B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
   2. Extruded Shapes: ASTM B221.
C. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.02 FIRE PROTECTION CABINET
A. Cabinet Type: Suitable for fire extinguisher.
   1. Products: Subject to compliance with requirements, provide one of the following:
      b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
      c. Larsen's Manufacturing Company.
B. Cabinet Construction: Non-rated.
C. Cabinet Material: Steel sheet.
   1. Shelf: Same metal and finish as cabinet.
D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
E. Cabinet Trim Material: Steel sheet.
F. Door Material: Steel sheet.
G. Door Style: Horizontal duo panel with frame.
H. Door Glazing: Tempered float glass (clear).
I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
J. Accessories:
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
K. Finishes:
   1. Manufacturer's standard baked-enamel paint for the following:
      a. Exterior of cabinet door and trim except for those surfaces indicated to receive another finish.
      b. Interior of cabinet and door.

2.03 FABRICATION
A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Provide factory-drilled mounting holes.
B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.04 GENERAL FINISH REQUIREMENTS
A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
C. Finish fire protection cabinets after assembly.
D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.05 STEEL FINISHES
A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
B. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
   1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION
A. Prepare recesses for semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION
A. General: Install fire protection cabinets in locations and at mounting heights indicated below:
   1. Fire Protection Cabinets: 54 inches above finished floor to top of cabinet.
B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
3.04 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 52 20
SECTION 10 80 10 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

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

1.02 SUMMARY
A. Section Includes:
   1. Toilet and Bath accessories.
B. At each toilet room provide:
   1. Accessories described on drawings.
C. Install Owner provided soap, paper towel, and tissue dispensers.

1.03 SUBMITTALS
A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
B. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.
C. Warranty: Sample of special warranty.

1.04 QUALITY ASSURANCE
A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.05 COORDINATION
A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.06 WARRANTY
A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 years from date of Substantial Completion.
PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      2. Other manufacturer approved by addendum prior to the receipt of bids.

2.02 MATERIALS
   A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
   B. Galvanized-Steel Sheet: ASTM A653, with G60 hot-dip zinc coating.
   D. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
   E. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
   F. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.03 FABRICATION
   A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
   B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six (6) keys to the Owner.

PART 3 - EXECUTION

3.01 INSTALLATION
   A. Install accessories according to manufacturers' written instructions.
   B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.
   C. Mounting Heights: As required by A.D.A.

3.02 ADJUSTING AND CLEANING
   A. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 80 10
SECTION 11 12 34 – ATTIC LADDER

PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section Includes:
      1. Fire Rated Access Ladder

1.03 SUBMITTALS
   A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating and finishes.
      1. Details of anchorages and connections.

1.04 QUALITY ASSURANCE
   A. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to NFPA 252.
   B. Smoke-Control Assemblies: Comply with NFPA 105 or UL 1784.

1.05 PROJECT CONDITIONS
   A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.06 COORDINATION
   A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1. Fakro America, LLC.
      2. Precision Ladders, LLC.
      3. Other manufacturer accepted by addendum prior to the receipt of bids.
   B. Fire Rated: 60 Min.
   C. Hatch: Insulated and Fire resistant
D. Ladder: Manufacturer’s standard.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
   C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION
   A. General: Install according to manufacturer’s recommendations.

3.03 ADJUSTING AND CLEANING
   A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including work that is warped, bowed, or otherwise unacceptable.
   B. Clean using products acceptable to the Attic Ladder manufacturer.

END OF SECTION 11 12 34
SECTION 12 30 40 – PLASTIC LAMINATE FACED CASEWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Plastic laminate faced casework and counter tops as indicated.
   2. Including locks for all doors and drawers.
   3. Including balanced construction of all panels.

B. Casework may be fabricated by specified manufacturer or shop fabricated by AWI certified fabricator.

C. Related sections include the following:
   1. Division 1 Section “Rough Carpentry” for Blocking.

D. See Division 1 Section “Alternates” for Solid Surface.

1.03 SUBMITTALS

A. Product Data for each type of casework unit specified.

B. Shop drawings for plastic laminate casework and fittings showing plan layouts, elevations, ends, cross sections, service run spaces, location of holes for service fittings, sinks and similar penetrations of this work.
   1. Include details and location of anchorages and fittings to floors, walls, and base, including required blocking.
   2. Include layout of units with relation to surrounding walls, doors, windows, and other building components.
   3. Coordinate shop drawings with Installers of other work, including plumbing, mechanical and electrical work.
   4. Include manufacturer’s recommendations for blocking and securing of plastic laminate casework units and fitting to the building floors, walls, and similar surfaces.

C. Samples for Initial Selection: Manufacturer’s full range of standard plastic laminate samples.

D. Maintenance data to be included in the “Operating and Maintenance Manual” specified in Division 1. Include operating and maintenance instructions, parts list, purchase source for operational and maintenance materials, emergency instructions, specific colors used, and similar information. Include name, address, and telephone number of the manufacturer’s nearest service representative.

1.04 QUALITY ASSURANCE

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver casework only after wet operations in building are completed.

B. Store completed casework in a ventilated place, protected from the weather, with relative humidity of less than 50 percent and temperature not less than 70 deg F.

C. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

1.06 PROJECT CONDITIONS

A. Environmental Conditions: Building is fully conditioned.

B. Field Measurements: Where casework is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.

1. Where field dimensions cannot be made without delaying Work, guarantee dimensions and proceed with manufacture of casework without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 – PRODUCTS

2.01 CASEWORK MANUFACTURERS

E. Available manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following or by an AWI certified fabricator:

1. Stevens Cabinet Company.
2. Case Systems Inc
3. Frederick’s
4. TMI Systems Design Corp.

2.02 MATERIALS

A. Plastic laminate for exposed surfaces (1600-G-3): High-Pressure laminate meeting NEMA LD-3-1991, Type 1, General Purpose, matte (suede) finish, unless indicated otherwise (1600B-S-1). Provide balanced construction on all laminate clad panels.

1. Exposed surfaces face with GP50 high pressure laminate include: Counter tops, back and end splashes. Clad edges of tops with same laminate, unless otherwise indicated.

2. Exposed surfaces faced with GP28 high pressure laminate include: Cabinet fronts, drawer fronts, cabinet doors, exposed end panels and cabinet ends, cabinet bottoms 42” or more above the finished floor, cabinet tops unless concealed or more than 78” above finished floor and not visible from above, both sides of shelves in open cabinets and wall mounted shelves, interior of open cabinets, interior of cabinets with glass doors, and vertical dividers in open cabinets.
a. Finish edges of cabinet faces, all four edges of shelves and similar edges with 1mm thick PVC moulding to match color and pattern of face.

b. Finish edges of doors and drawers with 3mm thick PVC moulding with rounded edges. Color selected by the Architect.

B. Plastic laminate for Semi-Exposed Surfaces (1600-G-3): Solid color thermally fused melamine meeting or exceeding the requirements of LD3-1991, NEMA minimum requirements for GP20, or CL20 (nominal 0.020") cabinet liner, matte (suede) finish (1600B-S-1). Provide balanced construction on all laminate clad panels.

1. Color and pattern of plastic laminate for semi-exposed surfaces: Selected by the Architect from the manufacturer’s standard neutral colors.

2. Semi-exposed surfaces include: Surfaces visible when doors and drawers are in the open position, and bottoms of cabinets which are more than 30” and less than 42” above the finish floor.
   a. Cabinet doors over 30” high: Provide GP28 backing, same color as interior of cabinet.

3. Top coated papers and paint are not acceptable.

C. Plastic Laminate for Sealed Surfaces (1600-G-3): Manufacturer’s option (1600-B-S-1). Provide balanced construction on all laminate clad panels.

1. Concealed surfaces include: Surfaces which are not visible after installation, bottoms of cabinets which are less than 30” above the finished floor, tops of cabinets which are over 78” above the finished floor and not visible from an upper level, and stretchers, blocking or components which are concealed by drawers including dust and security partitions between locker drawers.

2. Top coated papers and paint are not acceptable.

D. Particleboard Core: Minimum 45lb density panels, comply with ANSI A208.1, for thickness of less than 3/4 inch, except that modulus of elasticity and screw holding capacity on face and edge shall be not less than 350,000 psi, 300 lb, and 250 lb, respectively.

E. Medium Density Fiberboard Core: Minimum 48 lbs. density panels, for thickness of ¾ inch and greater, comply with ANSI A208.2, except that modulus of elasticity and screw holding capacity on face and edge shall not be less than 400,000 psi, 300 lb, and 250 lb, respectively.

F. Hardware:

1. Door and Drawer Pulls: Provide 4 inch wire type pulls with standard projection. Install door pulls vertically and drawer pulls horizontally.

2. Cabinet Door Hinges: Fabricated of minimum 0.095” thick tempered steel, 5 knuckle, fixed pin, hospital tip, 270 degree swing capability. Provide one pair for doors less than 48 inches high and 1-1/2 pair for doors over 48” high.
   a. Satin chromium plated finish over steel (BHMA 652).

3. Chain stops: Provide satin chrome plated steel (BHMA 652) chain restraint and anchorages, securely anchored to door leaf and cabinet body, and sized to prevent door from swinging into or contacting adjacent wall construction or countertops. Install at top of base cabinets, wall cabinets, wardrobe and ALL other cabinets at locations where interference can occur.
4. Drawer Guides: Provide nylon rollers with epoxy coated metal guide channels and integral stops to eliminate accidental removal of drawer. Provide guides designed to provide self-closing of drawer and to prevent rebounding action when drawers are closed with manual adjustment, left-to-right, for movement from 0” to 1/8”. Live load rating not less than 100 lbs. Provide 3 part progressive opening, full extension, guides for file drawers.

5. Locks:
   a. Provide locks on doors as indicated on the drawings.
   b. Locks: Dead bolt or cam bolt type as required by cabinet construction, pin tumbler cylinder, with satin chromium plated finish, BHMA 626. (Example: Olympus No. 100DR and 200DW)
   c. Key each cabinet in individual room alike, but different from other rooms.
   d. Provide two (2) keys for each lock.
   e. Provide four (4) master keys.
   f. Mark, engrave or stamp, lock number on each key and on matching lock face.

G. Accessories include:
   1. Closer Panels and Filler strips where required for closing space between cabinets and walls and ceilings, of same material and finish as cabinets.
   2. Finish backs and end panels where exposed.
   3. Back and end splashes.
   4. Shelving.
   5. Drawer roller guides.

H. Adjustable Shelf Supports: Cabinet manufacturer’s standard which will support maximum intended load, but not less than 200 lbs per square foot.

2.03 SEALANTS
   A. Provide silicone sealant for sealing between casework and surrounding surfaces. Refer to Division 7 Section “Joint Sealants: for proper sealant. Color: Match color of casework, wall or use clear.

2.04 FABRICATION
   A. General: Comply with 1600-G-8 for minimum thickness and material for cabinet components and with 1600B for construction, unless otherwise indicated.
   B. Casework Design: Flush overlay, except revealed at hinge jamb. Maintain a maximum 1/8” reveal between pairs of doors, between doors and drawer front, or between multiple drawer fronts within the cabinet.
   C. Shop fabricate casework to the greatest extent possible; disassemble only as necessary for delivery and installation.
   D. Fabricate tops of base cabinets with not less than ¾ inch thick by 4 inches wide stretcher, one along the front edge and one along the rear or provide ¼ inch think solid top.
E. Sub-base: Fabricate base cabinets and tall cabinets for separate sub-base. Construct of ¾ inch thick, APA EXT grade plywood, or 1 inch, nominal thickness, solid wood, in a ladder type design. Recess base ¼ inch at exposed and finished ends for resilient base.

F. Backs: Minimum ¼” thick rabbeded, mortised, mechanically anchored four sides and hot glued in place. Provide ¾ inch thick wood mounting or support rail at top and bottom of each cabinet, and in the middle of tall cabinets, fasten to back and to body of cabinet with hot glue and dowels.

G. Drawers: Completely finish fronts with high pressure laminate, GP28. Interiors: Same as cabinet interiors.
   1. Construction: Full box constructed from medium density fiber board with dovetail of glues dowel pin on all four corners. Bottoms: Mortised on four sides.
   2. Provide self closing door slides on all drawers with positive in-stop, out-stop and keeper.
   3. Provide frame rails between drawers, doweled into sides.
   4. Provide horizontal and vertical separator between each drawer.

H. Adjustable shelves: ¾ inch thick for spans up to 32 inches, and 1 inch thick for spans up to 42 inches. For spans greater than 42 inches, provide 1 inch thick shelves and additional support at the back of the cabinet. Shelves shall be adjustable on 1-1/4 inch (32 mm) centers. All cabinets have clear span interiors, unless specifically indicated otherwise (1600-G-8). Shelves shall not deflect more than 1/240 when uniformly loaded to 200 lbs per square foot.
   1. Edge all four edges, “matched edges”.

2.05 PLASTIC LAMINATE COUNTERTOPS

A. Quality Standard: Comply with AWI Section 400 and its Article 400C.
   1. Grade: Custom

B. Plastic Laminate Tops: Provide plastic laminate sheet, complying with NEMA LD 3, shop bonded with fully waterproof glue to both sides of 1-3/16 inches thick subtop of phenolic-resin-bonded particleboard. Sand surfaces to which plastic laminate is to be bonded.
   3. Color, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
      a. Color to be selected by the architect from manufacturer’s FULL range.
   4. Finish edges with 3mm thick PVC moulding with rounded edges. Color selected by the Architect.
   5. No-drip Edged Plastic Laminate Tops: Construct top and backsplash from one piece of plastic laminate with rolled edges and coved intersection. Provide separate and splashes, fitted to top. Provide at all countertops in Foods Lab.

C. Provide back splash, returns and side splashes, unless otherwise indicated, of construction, finish, and edges to match counter tops. Thickness: not less than ¾ inch.

2.06 SOLID SURFACE
A. Subject to compliance with requirements, provide products by one of the following:

5. Basis of Design: Corian® surfaces from the DuPont company,
   a. Color: To be selected from manufacturer’s full range.

6. Swanstone from The Swan Corporation,

7. Wilsonart,

8. Formica® Solid Surfacing,

9. Or approved equal prior to submitting bids.

B. Solid polymer components

10. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.

11. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.

12. Thickness: ½”

C. Integral bowl sink


14. Faucet hole drilling: 4” Centerset

15. Bowl Size: See drawings.

16. Color: As selected by architect from Manufacturer’s full range.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate type of blocking, wood or metal, placement, and location of blocking required to properly support this work. It is this Installer’s responsibility to properly install this work, and coordination of the blocking is part of this work.

3.02 CASEWORK INSTALLATION

A. Quality Standard: Install casework to comply with AWI Section 1700.

B. Install, plumb, level, true, and align with no distortions. Shim as required, using concealed shims. Where plastic laminate casework abuts other finished work, scribe and apply filler strips for accurate fit with fasteners concealed where practicable.

C. Fabricate and install separate sub-base. Anchor securely to the floor. Shim to level and to line.

D. Base Cabinets: Set cabinets straight, plumb and level. Adjust sub-tops within 1/16 inch of a single plane. Fasten each individual cabinet to sub-base at toe space with fasteners spaced 24 inches on center. Screw continuous cabinets together. Secure individual cabinets with no less than 2 fasteners into sub-base where they do not adjoin other cabinets.

1. Assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.
E. Install hardware uniformly and precisely after final finishing is complete. Set hinges snug and flat in mortises unless otherwise indicated. Turn screws to flat seat. Adjust and align hardware so that the moving parts operate freely and contact points meet accurately. Allow for final field adjustment after installation. Install grommets.

F. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

G. Provide cut-outs for plumbing devices and other penetrations; field-cut before filler panels and top closure panels are installed. Coordinate locations with plumbing contractor or subcontractor.

### 3.03 INSTALLATION OF TOPS

A. Field Jointing: Where practicable, make in same manner as factory jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer. Locate field joints as shown on accepted shop drawings, factory prepared so there is no jobsite processing of top and edge surfaces. Locate joints no closer than 6 inches from edge of sinks.

B. Fastenings: Use concealed clamping devices for field joints located within 6 inches of front, at back edges, and at intervals not exceeding 12 inches. Tighten in accordance with manufacturer’s instructions to exert a constant clamping pressure at joints.

C. Abut top and edge surfaces in one true plane, with internal supports placed to prevent any deflection. Provide flush hairline joints in top units using clamping devices.

D. Provide holes and cutouts as required for mechanical and electrical service fittings.

E. Carefully dress joints smooth, remove any surface scratches, clean and polish entire surface.

F. Provide scribe edge for closures at junctures of top, curb, and splash with walls. Use silicone sealant to seal junctures.

### 3.04 INSTALLATION OF ACCESSORIES

A. Install accessories in accordance with approved location drawings and manufacturer’s installation instructions. Turn screws to a flat seat; do not drive. Adjust moving parts to operate freely and smoothly without binding.

### 3.05 INSTALLATION OF SEALANTS

A. Install silicone joint sealants between countertop and backsplash to wall. If matching color is not available, use clear.

### 3.06 CLEANING AND PROTECTION

A. Repair or remove and replace defective work when directed upon completion of installation.

B. Clean finished surfaces, touch up where required and remove or refinish damaged or soiled areas to match original finish.

C. Protection: Advise Owner’s Representative of procedures and precautions for subsequent protection of installed plastic laminate casework and fittings from damage by work of other installers.

**END OF SECTION 12 30 40**
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Horizontal louver blinds with aluminum slats.

B. Provide Horizontal Louver Blinds:
   1. At all existing exterior Windows.
      a. Note: See window alternate
   2. At all interior Windows.
   3. At sidelites in hollow metal door assemblies.
   4. Do not provide blinds at storefront.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Samples for Initial Selection: For each type and color of horizontal louver blind indicated.
   1. Include similar Samples of accessories involving color selection.
C. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain horizontal louver blinds through one source from a single manufacturer.
B. Product Standard: Provide horizontal louver blinds complying with WCSC A 100.1.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds in factory packages, marked with manufacturer and product name and location of installation using same designations indicated in a window treatment schedule.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before
fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.01 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Hunter Douglas; Lightlines Aluminum Blinds
   2. Levolor, a Newell Rubbermaid Company; Levolor Custom Metal Blinds.
   4. Lafayette Interior Finishes; Traditions Aluminum Blinds.

B. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radiused corners.
   1. Width: 1 inch.
      a. Spacing: Manufacturer's standard.
   2. Thickness: .008 gauge min.
   3. Finish: One (1) color as selected by the Architect from manufacturer’s standard colors.
      a. Ionized Coating: Antistatic, dust-repellent, baked polyester finish.

C. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides with end plugs and the following:
   1. Capacity: One blind per Headrail.

D. Bottom Rail: Formed-steel or extruded-aluminum tube, with plastic or metal capped ends bottom contoured for minimizing light gaps with enclosed ladders and tapes to prevent contact with sill.

E. Ladders: Evenly spaced to prevent long-term slat sag.
   1. For Blinds with Nominal Slat Width 1 Inch or Less: Braided string.

F. Lift Cords: Manufacturer's standard.

G. Tilt Control: Enclosed worm-gear mechanism, slip clutch or detachable wand preventing over rotation, and linkage rod, and the following:
   1. Tilt Operation: Manual with clear plastic wand or cord-operated tilter.
   2. Length of Tilt Control: Length required to make operation convenient from floor level.
   3. Tilt: Full.

H. Lift Operation: Manual, cord lock; locks pull cord to stop blind at any position in ascending or descending travel.

I. Tilt-Control and Cord-Lock Position: Right and left side of headrail, respectively, unless otherwise indicated.

J. Mounting: Window head wall framing mounting between the jambs, permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.
1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.

K. Side Channels and Perimeter Light Gap Seals: Manufacturer's standard.

L. Colors, Textures, Patterns, and Gloss: As selected by Architect from manufacturer's full range of standard colors.

2.02 HORIZONTAL LOUVER BLIND FABRICATION

A. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.


B. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows:

1. Blind Units Installed between (inside) Jambs: Width equal to 1/8 inch per side or 1/4 inch total, plus or minus 1/8 inch, less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch, plus or minus 1/8 inch, less than head-to-sill dimension of opening in which each blind is installed.

C. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting Headrail, and operating hardware, and for hardware position and blind mounting method indicated.

D. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

E. Color-Coated Finish:

1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

F. Component Color: Provide rails, cords, ladders, and exposed-to-view metal, and plastic matching or coordinating with slat color, unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install horizontal louver blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior slat edges in any position are not closer than 1 inch to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware if any.

1. Head mounted between the jambs.
3.03 ADJUSTING
   A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free of binding or
      malfunction throughout entire operational range.

3.04 CLEANING AND PROTECTION
   A. Clean horizontal louver blind surfaces after installation, according to manufacturer's written
      instructions.
   B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and
      Installer, that ensure that horizontal louver blinds are without damage or deterioration at time
      of Substantial Completion.
   C. Replace damaged horizontal louver blinds that cannot be repaired, in a manner approved by
      Architect, before time of Substantial Completion.

END OF SECTION 12 49 10
SECTION 220300 – PLUMBING DEMOLITION

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020, 019030 and in applicable portions of related technical sections, as if they are repeated within this section.

1.02 Work Described In This Section: Is intended to expound upon demolition notes indicated on the drawings, and shall be as though they were included in the general notes and/or plan notes found on the demolition drawings. Proportions of this section may also apply to new work, such as the need to use electronic tracking or locating equipment to establish location and inverts prior to cutting of floors, etc.

1.03 Furnish (temporarily install and remove when necessary) materials, supplies, labor, equipment, tools, transport, removal of debris, equipment and material made obsolete by this project. Provide remaining equipment, facilities and services as required for incidental work as shown, required, or implied on the Drawings and/or specified herein.

1.04 Codes and Standards: All work shall conform to the Rules and Regulations of the International Plumbing Code, International Mechanical Code, and all other applicable State and Local Codes and Ordinances covering this work.

1.05 Contractor Owned (or Leased) Equipment Used on the Project: Maintained and used in a safe and appropriate manner for its intended use. Labor personnel operating said equipment, shall be trained and experienced with proper use and operation of the equipment.

1.06 Qualifications of Personnel: Performing work pertaining too this Section shall be familiar with the scope and requirements of the entire project.

1.07 Demolition Within the Confines of (or Adjacent to) the Building or Structure: Shall be performed in a manner which protects and preserves existing conditions that are to remain. Contractor performing demolition work shall be financially responsible for having a qualified contractor (approved by A/E and the Owner) to repair or replace any damaged work. Damages (including structure and finishes) shall be repaired or replaced to an acceptable condition.

A. Repair of structure and finishes indicated above, also applies to disturbed walls, floors, ceilings & roofs which were damaged or disrupted as a result of performing demolition work (unless repairs are assigned to another subcontractor, or work is scheduled to receive new finishes under this project).

B. Work performed on roofs still under warranty shall be performed in an approved manner, which will not void the warranty.

1.08 System Shut-Down’s and Demolition Work: Scheduled with the Owner and end users of the facility, prior to commencing work.

1.09 Temporary Services, or Provisions: Provided for the facility (or portions thereof) when indicated on the drawings or specifications. Any such provisions shall be coordinated with the Owner, end users and the Architect / Engineer and shall be suitable for meeting the needs of the facility.

1.10 Work indicated on the drawings are based on the Owner’s existing drawings of the building, when they are available and upon limited amount of on-site survey. Buried (or otherwise inaccessible) piping is shown based on existing drawings (which may or may not be “record drawings”) and the apparent location and location of cleanouts. Extra compensation will not be granted for unnecessary floor cuts and patches, or for unnecessary removal and replacement of existing buried piping, etc.
1.11 Locate and determine invert/top of pipe elevations, etc. for buried service lines, including sanitary, storm, water, etc. as required to perform work, prior to cutting floor slab.

PART 2 – MATERIAL (Not Used)

PART 3 – EXECUTION

3.01 Work made obsolete by this project, whether indicated on the drawings or not: Disconnected, removed and disposed of off site in an approved manner, unless noted otherwise. Material shall be legally disposed of at an acceptable location and in an acceptable manner.

A. Owner shall have the first right of refusal on any equipment made obsolete by the project, prior to contractor removing it from the site. Should the Owner retain said equipment, the contractor shall place same in owner’s storage room/building as directed by the Owner.

3.02 Prior to cutting the floor, all buried (or otherwise inaccessible) storm and sanitary d-w-v piping intended (or as determined in the field) to be used for new tie-in points to serve new or renovated areas, shall be cleaned, inspected and demo work performed in the following sequence:

A. Interior of piping shall be rodded and power flushed clean prior to reconnecting tie-in’s.
B. Begin cutting the floor and perform demolition as required, only after tie-in points have been established and confirmed.

3.03 Piping noted as being demolished shall have each live end and abandon end cut and capped. Live end of any capped fuel gas pipe shall be provided with permanently affixed signage or tag identifying it as a “fuel gas” if there is no other visible pipe identification within ten feet (10’) of the cap.

A. Do not remove existing piping, until all tie-in points and reuse of respective piping has been field verified. There will be no compensation for premature removal (and required reinstallation) of piping intended to be re-used. Use of a sewer cam is recommended prior to cutting floor when drain location, elevation and condition is in question.

B. Piping located below slab-on-grade and inside of walls (to remain), may be abandoned in place and capped inside of wall, or below the finished floor. Cap shall be located a minimum of: 1” beyond face of stud wall, 2” beyond face of masonry or poured concrete wall, and 6” below finished floor.

C. All open ended pipe and valves shall be plugged, or capped.
D. Gas lines shall be safely vented and purged to atmosphere, prior to disconnection. Refer to Section 221616 for additional information and requirements.

1. Abandonment of gas lines within inaccessible spaces and below floor slabs-on-grade shall be prohibited. Piping system must be removed in such spaces.

E. Interior downspouts shall only be removed at a time when the forecasts are not predicting rain within the window of time that it takes to install and connect/reconnect new work. Do not permit rain water to enter into the building. If there’s a potential for rain, provide temporary PVC pipe and fittings as required to assure safe and dry conditions inside the building.

F. Provide temporarily installed caps, or pneumatic (or mechanically) operated test plugs all openings on live storm and/or sanitary d-w-v lines extending up from below floor slab, until above floor piping is reconnected. Test plugs shall be rated for the potential amount of static head and back pressure that it may be subjected to. Provide temporary drainage from roof if necessary to
evacuate full amount of volume based upon: square footage of roof drainage area affected x 3.5”/hr of rainfall intensity x 0.0114 (A x inches/hour x 0.0114)

3.04 Cutting and removal of concrete floor slabs shall be accomplished by saw cutting the perimeter edge to a minimum depth of 2”, before breaking up and removing the rubble.

3.05 Existing sanitary d-w-v- piping which is indicated, as serving new (or renovated) areas shall be rodded with mechanical device designed to scrub buildup from pipe walls, followed by a thorough power flush where noted on the drawings. All existing main and branch (or lateral) piping shall be cleaned out its entire length to the first sanitary manhole outside of the building where debris shall be collected and hauled off for proper disposal. Cleaning shall continue until clear water is flowing into the manhole for a period of 15 minutes.

END OF SECTION 220300
SECTION 220500 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Furnish and install all materials, supplies, labor, equipment, tools, transportation, facilities and services necessary for, and required in connection with, properly incidental to the work as shown on the Drawings and/or specified herein or reasonably implied therefrom.

1.03 **ASME Certificates:** Submit to the Architect an ASME Certificate for each pressure vessel, which is specified to be constructed, and stamped, in accordance with ASME requirements.

1.04 **Qualifications of Installers:** For the actual fabrication, installation and testing of the work in these Plumbing Sections, use only thoroughly trained and experienced personnel, who are completely familiar with the requirements for this work, and with the installation recommendations of the manufacturers of the specified items.

1.05 In acceptance or rejection of installed plumbing system, no allowance will be made for lack of skill on the part of installers.

1.06 **Codes and Standards:** All work shall conform to the Rules and Regulations of the International Plumbing and International Mechanical Codes and State Amendments, as well as Local Codes and Ordinances covering these installations.

1.07 All materials shall bear the manufacturer's name, trade name and the UL or ASME label in every case where a standard has been established for the particular material.

1.08 **Parts of the work** governed by the section shall comply with the latest editions of the following applicable standard specifications and codes; for other standard specifications that if included by reference, see Division 1 of the Specifications.

- **ASME** American Society of Mechanical Engineers
- **ASHRAE** American Society of Heating, Refrigeration and Air Conditioning Engineers
- **ACRI** Air Conditioning and Refrigeration Institute
- **ASTM** American Society of Testing Materials
- **ASA** American Standard Association
- **AWWA** American Waterworks Association
- **NFPA** National Fire Protection Association
- **IBR** Institute of Boiler and Radiator Manufacturers
- **UL** Underwriters' Laboratories
- **NEMA** National Electric Manufacturer's Association
- **NEC** National Electric Code
- **SMACNA** Sheet Metal and Air Conditioning Contractor's Association
- **BOCA** Building Officials and Code Administrators
- **IAPMO** International Association of Plumbing and Mechanical Officials
- **FM** Factory Mutual
- **USC-FCCC & HR** University of Southern California – Foundation for Cross-Connection Control & Hydraulic Research
1.09 Local Building Code: Include all items of labor and material required to comply with such codes in accordance with the Contract Documents. Where quantities, sizes or other requirements indicated on the Drawings or herein specified are in excess of the code requirements, the Specifications and/or Drawings shall govern, regardless of code requirements.

1.10 Laws of the Land (Local Ordinances, State and Federal Laws): Complied with, unless proper variances have been granted in writing.

1.11 Welding: Pipe Welding shall be welded by A.S.M.E. certified welders, and the procedure outlined in Chapter 4, Section 6, "Welding of Pipe Joints", of the American Standard Code for Pressure Piping (ASA B31, 1-1951) shall be followed; each welded joint shall be identified with the stamp of the operator performing the weld as provided for in the certification procedure.

1.12 Before any piping welding is performed, the Contractor shall submit to the Architect a copy of his welding procedure specifications together with proof of its qualification as outlined and required by the most recent issue of the code having jurisdiction.

1.13 Before any operator shall perform any pipe welding, the Contractor shall also submit to the Architect, the operator's qualification record in conformance with the provisions of the code having jurisdiction, showing that the operator was tested under the proven Procedure specification submitted by the Contractor.

1.14 Standard Procedure Specifications and operators qualified by the National Certified Pipe Welding Bureau shall be considered as conforming to the requirements of these specifications.

1.15 Contractor shall be responsible for the quality of welding done and shall repair or replace any work not in accordance with these specifications.

1.16 Piping systems shall be tested for ANSI/NFPA Z223.1 for fuel gas systems and ASTM B31.9 for all other building service piping systems, unless indicated otherwise in specific system sections.

END OF SECTION 220500
SECTION 220503 - PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 This Section applies to all piping installed as a part of this Contract.

1.03 Piping Systems are specifically described in other sections of this specification.

1.04 Pipe sizes indicated herein or on the Drawings, refer to the nominal inside pipe diameter.

1.05 Copper (water) tube size as defined in the project manual (maybe also be referred to as “pipe” on the drawings), refers to the nominal outside diameter, also known as Copper Tube Size (C.T.S.) when used in reference to PEX and other tubing products.

1.06 Submit descriptive literature and shop drawings for approval.

A. Methods and material submitted under this Section are not required to be submitted a second time under the applicable System Section(s), such as “Section 221116 - Hot & Cold Water System”, and “Section 221616 – Gas Piping System”, etc.

1. Submittal to be titled “220503.01 - Pipe & Pipe Fittings”, etc. but all other applicable System Section number(s) shall be referenced on the submittal sheet.

B. Methods and materials not covered under this Section shall be submitted under the appropriate System Section(s), such as traps and cleanouts in “Section 221313 – Soil & Waste Piping Systems”, etc.

C. If methods and materials are in conflict between this Section and applicable System Section(s), it shall be submitted under the applicable System Section(s), and the differences noted.

1.07 Where product data is submitted for pipe and pipe fittings and they are common to multiple sections, they may be combined into one submittal covering those sections, providing the following criteria is met:

A. Each product is to be identified for use by each section number and name and when more than one given type of product listed, each one shall be identified for use by the respective section names and numbers: IE: If Charlotte Pipe & Fittings were to be submitted with the intention of using PVC- DWV pipe & fittings for both storm and sanitary drainage systems and cast iron pipe & fittings to be used at high temperature drain locations on part of the sanitary drainage system, this information is to be conveyed on the submittal along with the name and number of each relevant section and the ASTM/ANSI numbers involved with each product.

PART 2 - PRODUCTS

(Note: When any of the following products are used in a potable water piping systems, the wetted surfaces shall contain a purposeful amount of lead equal to (or less than) 0.25% as defined by the updated NSF '61' as "Low Lead", regardless of description, model numbers used.)

2.01 PIPE MATERIAL

A. Black steel and Hot-Dipped Zinc Coated - ASTM specification – A53 Welded and Seamless.

B. Cast Iron Soil Pipe (Service Weight) - ASTM specification - A74: Bear the collective trademark stamp of Cast Iron Soil Pipe Institute (CISPI) and Listed by National Sanitation International.
1. Acceptable Manufactures: AB&I Foundry, Charlotte Pipe & Foundry, or Tyler Pipe.


1. Acceptable Manufactures: AB&I Foundry, Charlotte Pipe & Foundry, or Tyler Pipe.

D. Copper Tube (or Pipe) Type K, or L - ASTM specification – B-88, NSF 61 Low Lead (provide certified dimensional data when necessary).

E. Copper Drainage Pipe DWV - ASTM specification - B306.

F. Concrete Pipe, Reinforced - ASTM specification - C76 Class III for 12" or larger, or in trenches deeper than six (6) feet, or when installed under paved areas.

G. Ductile Iron Pressure Pipe & Appurtenances (Including: gaskets, polyethylene encasement, etc.) - ANSI/AWWA specifications: - C151/A21.51 (Pipe); - C150/A21.50 (Thickness Design of Pipe); - C111/A21.11 (Gaskets); - C104/ A21.4 (Cement Mortar Lining); - C105/A21.5 (Polyethylene Encasement); NSF 61 Low Lead.

H. Direct Bury, pre-insulated copper piping system using Type K - ASTM Specification B88, NSF 61 Low Lead (as specified here-in).

I. Polyvinyl Chloride (PVC) Rigid Pipe - ASTM specification - D1785 (Also applies to PVC-DWV Double Containment Piping Systems).


J. High Density Polyethylene (HDPE) Pipe for Horizontal Direction Boring Underground Nominal 4” and 6” pipe (Inside or Outside): PE-4710 Pressure Pipe; 4” Solid wall PE SDR 9, 250 PSI; ASTM F-417; ASTM D-3035; Smooth wall pipe fabricated based on controlled outside diameter pipe such as “Smooth Wall Innerduct” as manufactured by Blue Diamond, Industries, LLC.


M. Polyvinylidene Flouride (PVDF) acid resistant, Schedule 40, D-W-V pipe and fittings used in “plenum rated” spaces – ASTM F-1673. Acceptable Manufactures: Orion, Enfield/Labline, or Zurn Chemical Drainage System.


O. Pipe sizes indicated herein or on the Drawings unless otherwise noted, refer to the nominal inside diameter.

2.02 FITTINGS

A. Malleable Iron Threaded - Black or Hot-Dipped Galvanized - ANSI specification - B16-3 (150 and 300 PSI pressure rated).

C. Butt Weld, factory made Wrought Steel - ANSI specification - B16.9.
D. Socket Weld, Forged Steel - ANSI specification - B16.11.
E. Hub & Spigot (Service Weight - DWV) - ASTM specification - A74: Bear the collective trademark stamp of Cast Iron Soil Pipe Institute (CISPI) and Listed by National Sanitation International.
   1. Acceptable Manufactures: AB&I Foundry, Charlotte Pipe & Foundry, Tyler Pipe, or prior approved equal.
F. Ductile Iron Pressure Fittings & Appurtenances (Including: gaskets, polyethylene encasement, etc.) - ANSI/AWWA specifications: - C153/A21.53 (Compact Fittings), - C111/A21.11 (Gaskets); - C104/ A21.14 (Cement Mortar Lining); - C105/A21.5 (Polyethylene Encasement); NSF 61 Low Lead.
   1. Acceptable Manufactures: AB&I Foundry, Charlotte Pipe & Foundry, or Tyler Pipe.
H. Copper, Wrought - ANSI specification - B16.22; NSF 61 Low Lead. (Field insulated, per the pipe manufacturers written installation requirements.)
I. Copper Drainage - ANSI specification - B16.23.
J. Grooved Type:
   1. Malleable Groove Type - ASTM A47; NSF 61 Low Lead.
   2. Ductile Groove Type - ASTM A536; NSF 61 Low Lead.
   3. Cast Iron Groove Type - ASTM A48, Class 30-A; NSF 61 Low Lead.
   5. Fusion welded and mechanically joined fittings, joints and accessories for acid resistant D-WV (PP, PVDF & CPVC) drainage systems shall be as specified above under “Pipe Material”.
K. Mechanically Pressed Copper Fitting System: Water piping systems only; 200 PSI operating pressure at 180°F; 50 Warranty; NSF 61 Low Lead. Approved Manufactures – Viega Pro-Press, Nibco, Elkhart “X-Press”.
   1. If mechanically pressed copper fitting system is used on the project: Provide Owner with one new crimping tool and a full range of jaw attachments for pipe sizes ½” - 4” and all other applicable accessories for the maintenance and connection to the system.
   2. Provide Owner with one original DVD and one DVD copy of the same comprehensive training class provided to contractors when first being trained on the joint/fitting system. Each DVD shall be housed in a substantial jewel case and labeled by content, date, name and contact numbers of the system sales rep and company contact information, etc.
   3. Provide Owner with the name and contact information of the local sales representative and distributor of the system.
   4. Exception: The above tools and information are not required when press fittings are used in an isolated part of an otherwise sweat copper piping system due to valid reasons: when “first” approved by the system engineer or when noted on the drawings.
   1. Double containment type when applicable.
M. Fittings shall, in all cases, match the pipe to which they are joined and shall be suitable for the service intended.

N. Fittings in lines 2" or smaller shall, in general, be threaded or press fit and those in lines 2-1/2" or larger shall be grooved, press fit, welded or flanged (allowing for full flow). Fittings in lines 2" or smaller may, at the Contractor's option and with the written approval of the Architect/Engineer, be welded.

O. All branch Connections shall be made with standard "tee" or "wye" fittings. Mechanically extracted tees not permitted.

2.03 JOINTS

A. Threaded and coupled piping systems shall be joined with properly lubricated threaded joints. Pipe shall be cut smooth and square and burrs shall be removed with a reamer. Tapered threads shall be properly cut on the male end of the pipe and shall be of a sufficient number so that when the pipe is pulled up tight in the coupling, at least three full threads remain exposed. Joints shall be made tight with graphite and oil or by means of a pipe joint compound applied to the pipe threads only and not to the fittings. No pipe thread caulking compound shall be used. On galvanized piping systems after the piping has been fully assembled and tested all exposed threads shall be painted with a heavy coat of red lead or other rust inhibitive paint. Teflon tape may be used in lieu of the above specified pipe joint compounds at the Contractor's option.

B. Welded joints shall be made in accordance with the latest acceptable practices, codes and recommendations of the American Welding Society and the ASME.

C. Service Weight Piping Systems: Neoprene compression gasket joints shall be made up using either Tyler "TY-SEAL", or "Charlotte Seal" gaskets. They shall conform to ASTM C564 specifications. Such gaskets shall be installed in strict accordance with the manufacturer's latest published installation and application instructions.


1. 1-1/2" – 4": Four (4) bands
2. 5" – 10": Six (6) bands

E. Ductile Iron Pressure Pipe:


2. Mechanical joint with mechanical joint retainer gland for cast/ductile iron pressure pipe at fittings - ANSI specification A21.11, rubber gasket push-on.

F. Brazed joints shall be made using a filler material conforming to AWS A5.8-81, 95-5 hard solder (complying with NSF 61 Low Lead) requirements. All solder joints shall be made using the recommended flux for the solder selected. Solder joints in lines 2-1/2" or larger shall have both male and female members properly tinned before joining.
G. All joints between copper and ferrous materials shall be made up using an approved isolating connection equal to those produced by Epco Company of Cleveland, Ohio, or Victaulic Dielectric Waterway to prevent electrolysis and shall comply with NSF 61 Low Lead requirement.
   a. O-Ring style coupling joints may be utilized when part of a pre-insulated piping system and furnished, and warranted, by the manufacturer. Joints shall be field insulated per the pre-insulated pipe manufacturer’s written installation requirements.

H. Joints between unlike materials, such as cast iron and PVC pipes, shall be made using standard adapters or, if such adapters are not available, by other approved means acceptable to the administrative authority having jurisdiction and the Architect/Engineer.

I. Groove joints for steel pipe shall be “Victaulic, Tyco-Grinnell, Anvil-Gruvlok”, or approved equal. Grooved fittings shall be Victaulic full flow malleable iron ASTM A47, or approved equal by “Tyco-Grinnell, or Anvil-Gruvlok” and shall comply with NSF 61 Low Lead requirement.

J. Groove joints for cast or ductile iron pressure pipe shall be “Victaulic, Tyco-Grinnell, Anvil Gruvlok” or approved equal. Grooved fittings shall be Victaulic full flow ductile iron cast ASTM A536 and shall comply with NSF 61 Low Lead requirement.

K. Grooved joints for copper pipe 3 ½" and larger shall be a rolled grooved system by “Victaulic, Anvil-Gruvlok CTS”, or approved equal. Fittings shall be standard radius design, grooved and NSF 61 Low Lead compliant, ready for installation with copper grooved couplings and EPDM gaskets. Grooved copper flange adaptors, fittings and couplings shall have a working pressure of 300 PSI and shall be constructed per ASTM B-75 and ANSI B-16.22.

L. Mechanically Pressed Copper Fitting System: EPDM o-ring seals and mechanically crimped connections and NSF 61 Low Lead compliant; Fittings shall be designed such that an invalid connection will readily fail a pressure test.

M. Polyvinyl Chloride (PVC) rigid D-W-V pipe and fittings: Purple primer and solvent weld cement formulated for the specific installation conditions.
   1. Double containment PVC piping shall have joints made up per the manufactures installation requirements.

N. Restrained joint, IPS - PVC pipe shall have integral bell joints per ASTM D-2241, restrained by a reinforced spline which is installed with a spline groove and out of the spline hole within the bell of the pipe.

O. Polypropylene (PP) and Polyvinylidene Flouride (PVDF) D-W-V acid resistant pipe and fittings: Mechanical joints in casework and electrofusion socket fusion joints in concealed (or underground) installations.

P. Chlorinated Polyvinyl Chloride (CPVC) rigid D-W-V acid resistant pipe and fittings: Mechanical joints in casework and specially formulated one step solvent cement joints in concealed (or underground) installations.

2.04 FLANGES, GASKETS & UNIONS

A. Welding flanges shall be forged steel, welding neck, raised face and bolt holes spot faced on back; of proper weight and design to match corresponding valve or fitting. Bolting shall conform to ANSI B16.5. As an option, contractor may use convoluted, cold-formed steel flanges conforming to Section VIII of ASME Code for Unfired Pressure Vessels in lieu of standard forged steel flanges, ANSI B16.5. Convoluted flange material shall conform to and meet ASTM A516.

B. Threaded flanges shall, unless otherwise noted, be 125-pound design cast iron with raised face
boltholes spot faced, galvanized or black to match adjoining pipe.

C. Copper flanges shall be cast copper, ASTM standard, for solder connection and NSF 61 Low Lead compliant.

D. Groove type “Victaulic” flanges and flange adaptors for steel pipe shall be 125/150-pound malleable iron with flat face and pressure responsive synthetic rubber gasket, galvanized or black to match adjoining pipe, style 741 or approved equal by “Tyco-Grinnell, or Anvil-Gruvlok”.

E. Groove type “Victaulic” flanges and flange adaptors for cast or ductile iron pressure pipe shall be 125/150-pound malleable iron with flat face and pressure responsive synthetic gasket, black to match adjoining pipe, NSF 61 Low Lead compliant, style 341, or approved equal by “Tyco-Grinnell, or Anvil-Gruvlok”.

F. Groove type “Victaulic” flanges and flange adaptors for cast or ductile iron pressure pipe shall be 125/150-pound malleable iron with flat face and pressure responsive synthetic gasket, black to match adjoining pipe, NSF 61 Low Lead compliant, style 341, or approved equal by “Tyco-Grinnell, or Anvil-Gruvlok”.

G. Gaskets on domestic hot and cold water lines shall be Cranite.

H. Unions shall be 150-pound malleable iron, female pattern, brass to iron seat, ground joint, black or galvanized to match pipe being joined. Install unions adjacent to the downstream side of each threaded valve, on inlets and outlets of all specialties, apparatus and equipment having threaded connections to facilitate easy removal for repair or replacement, and elsewhere as shown on plans.

I. Gaskets for groove type couplings shall be "Victaulic" grade "E" (EPDM) or equal for chilled or hot water services with temperature limits of -30 degrees to 230 degrees F, or equal by “Tyco-Grinnell, or Anvil-Gruvlok”.

J. Restrained joint IPS – PVC pipe: O-Ring seal.

2.05 DIRECT BURY PRE-INSULATED PIPING SYSTEM

A. Direct bury pre-insulated piping system shall consist of 20’ long Type K copper tube (ASTM B-88 and NSF 61 Low Lead compliant,) carrier pipe with factory applied closed cell polyurethane insulated annular space with a Type 1, Grade 1 PVC or HDPE vapor barrier / jacket assembly (min. 0.060” thick), rated at 150 psi wp at 40 degrees F to 250 degrees F.

B. Insulation shall have a nominal density of 2-lb/ cu.ft. “K” factor of 0.14 BTU in./(HR)(SF)(degrees F) at 73 degrees F with ends factory applied with latex coating to assure moisture protect at all joints.

C. Joints shall be made and insulated in the field as recommended by the manufacturers written installation instructions. After pressure testing (as “domestic hot and cold water piping systems”) seal with sealing tape and heat shrink.

D. Approved systems are: “Copper-Gard” by Perma-Pipe/Ricwil, “250 Copper” by Insul-Tek, “Copper-Therm” by Thermacor or approved equal.

E. “EcoFlex Potable PEX” by Uponor may be used as an optional piping system for underground piping.
PART 3 - EXECUTION

3.01 All piping shall be installed as shown on the Drawings.
   A. Compressed air lines shall be pitched one inch (1”) in forty feet (40’) in direction of flow unless noted otherwise.
   B. Storm and Sanitary Sewer piping shall be pitched at not less than ¼” per foot for piping less than 3” in size and 1/8” per foot for piping 3” and larger (unless noted otherwise).
   C. Gravity sanitary piping which is bored into a facility and pulled out to the bore pit may be installed at a pitch of 1/8” per LF.
   D. Gravity sanitary which is bored into a facility and pushed in from the bore pit shall be installed at a pitch of 1/4” per LF.

3.02 Piping shall be installed in true horizontal and vertical planes at right angles or parallel to building walls. Diagonal or bent piping will not be permitted.

3.03 Piping shall be installed tight to slabs, beams, joists, etc., where possible and such that any removable ceiling panels may be removed for access above ceilings.

3.04 Fittings shall be used for all changes in direction and all branch connections.

3.05 Do not use bullhead tees, street elbows, or bushings.

3.06 Any change in pipe size shall be made eccentrically in a manner to prevent air pockets in water lines or water pockets in air or gas lines.

3.07 Provide drain valves at low points of piping systems and automatic air vents in high points. Install piping free of air or water traps, sags, and bends.

3.08 All piping shall be concealed above ceilings, in walls, in chases, in utility spaces or furred-in spaces wherever possible (except in equipment rooms). Pipe serving equipment mounted against wall shall be concealed in wall behind unit and shall extend through the wall into back of the unit. No exposed risers from floor or ceiling to unit will be accepted.

3.09 Unions shall be furnished and installed adjacent to each valve, at the final connection to each piece of equipment or plumbing fixture, and where otherwise shown on the drawings and/or required.

3.10 Access shall be provided for operation, adjustment and maintenance as required. Where possible, install work-requiring access in an approved accessible location that will not require an access panel.

3.11 Unions shall be installed adjacent to each threaded valve and on inlets of all specialties, apparatus and equipment having threaded connections, to facilitate easy removal for repair or replacement, and elsewhere as shown on drawings. Unions may be omitted in grooved piping systems.

3.12 Flanges or grooves are required on valves, apparatus and equipment with 2-1/2" or larger connections.

3.13 All piping shall be installed so as to allow for normal expansion and contraction without damage to pipe, building or equipment. Expansion loops shall be provided as shown on the drawings and/or as required.

3.14 Install piping connected to equipment so that pipe is not forced or sprung thereby exerting stress or strain on equipment. Contractor shall disconnect piping at equipment in order to demonstrate this at Engineer's request.

3.15 All pipe shall be carefully reamed. Threaded pipe shall have full length clean cut threads. Compression joints shall not be used.
3.16 Ends of all copper tubing and the interior of the cup of the fitting shall be thoroughly cleaned, deburred, and prepared prior to the application of the flux and solder. The flux shall not be used as a substitute for proper joint preparation. Wipe excess flux from each joint to prevent corrosion.

3.17 Underground domestic hot water piping shall be encased in foamed plastic insulation when installed within the confines of the building, unless noted otherwise.

3.18 Outside underground piping shall have not less than 60" bury to top of pipe, unless otherwise noted.

3.19 Provide proper support and anchoring for all respective underground pipe installations. Protect underground pipe from damage due to settling of new filled areas under pipe and from the zone of influence from structural footings. Include thrust blocks, yokes, etc., where required.

3.20 No service line shall be laid in or on the backfill or another service line trench except at the point of crossing of the two lines. Where lines cross the upper of the two shall be supported on concrete or other approved piers to prevent any settlement of the upper line onto the lower one. In no case shall water and sewer lines be laid in the same trench.

3.21 Where water piping passes over electrical gear or buss duct, furnish and install a galvanized sheet metal drip shield to divert any water that might leak onto electrical equipment. Shield shall extend a minimum of 12” all the way around the gear.

3.22 Storm, Sanitary, and Condensate Drainage Piping Located Above Ceilings of Kitchen Serving, Dining, Food Storage/Prep Areas, and Dishwashing Areas: Provided with double containment drainage piping as required by the Indiana Department of Health. The underside of floor drains above shall be protected by a (flexible) inverted bell device which surrounds the drain body (sealing to the underside of the floor slab above) with the lower end and vertical containment pipe attaching to the horizontal containment piping system. Provide 1-1/2” low point drain(s) (without valving) on the horizontal containment piping system, and extend to nearest available and (visible) floor drain.

A. If PVC (carrier pipe) material is used: Provide Sch. 40 PVC-DWV x Sch. 40 PVC-DWV double containment piping system.

B. PVC Carrier pipe shall not be used when the temperature of the liquid is in excess of 140° F (containment piping to be Sch. 40 CPVC-DWV when water temperature exceeds 140° F).

C. Provide comparable double containment piping systems for carrier pipe materials other than PVC (ie: cast iron x PVC-DWV; copper x PVC-DWV; acid resistant DWV x acid resistant DWV; piping systems, etc.).

D. PVC containment piping located in plenum spaces (or in adjacent rooms which are open to plenum spaces), shall be wrapped with an Armaflex type of pipe insulation, having a developed flame and smoke spread rating of 25/50 or less.

3.23 Provide ample space between piping for insulation or jacket covering.

3.24 Installation of Thermometers & Aquastats:

A. Thermometer & Aquastats: Provided with thermal wells.

B. Thermal Well Locations: Increase pipe by pipe size and install tee fitting.

C. Thermal Well Installation: Install in the “through leg” of the tee, opposing flow from the other “through leg”, with flow existing side leg of the tee.

D. Thermal Well and Sensor Stem: Length and method of installation shall assure that a minimum of 50% of the sensor is within the flow of the liquid.
3.25 Pipe and fittings shall be stored on job site in such a manner to prevent dirt and foreign matter from getting into pipe. Before installation, pipe shall be cleaned on the inside so that a minimum amount of debris enters the piping system.

3.26 All lines passing through outside of building walls above grade, shall be caulked water tight to prevent leakage into the building.

3.27 All underground lines passing through the building’s exterior walls into sub-grade floor level (or crawl space) shall be sleeved with integral water stop flanges on the outside of the wall. Annular space between sleeve and pipe shall be sealed water tight by using link seal type devices to prevent water infiltration into the building.

3.28 Escutcheon plates shall be installed wherever exposed pipe passes through walls, or ceilings of finished portion of building. Caulk around pipes passing through floors.

3.29 Sleeves shall be installed during construction and provided for all pipe passing through foundations and foundation walls, floors, walls, slabs, or beams, and shall have a minimum of 1” annular space between the pipe and the sleeve to allow for pipe movement. Do not mortar in any pipe to building construction.

A. All invert and pipe centerline elevations shall be coordinated and finalized prior to setting sleeves. Contractor shall be financially responsible for required core drilling as result of not maintaining documented sleeve coordination with the other trades and site conditions.

B. Sleeve Material: Above grade installations shall be Sch. 40 Galvanized Steel; below grade installations shall be Pressure Class 350 ductile iron pipe. Carrier pipe shall not come in contact with the pipe sleeve.

C. Sleeves shall be secured to the structure through which it penetrates.

D. When exterior basement (or underground vault) walls are penetrated, sleeves shall have an exterior water stop and mechanically secured clamping ring capable of providing a water proof seal in conjunction with (an exterior) field applied water proofing membrane. Such exterior wall penetrations shall be provided with a mechanically sealed rubber device, like “Link Seal” or approved equal.

E. Sleeves shall be extended beyond the 45º plane of influence off the nearest bottom edge of any adjacent footing, which would otherwise impose structural loading on the pipe. Encase steel, or ductile iron sleeves in reinforced 4,000 PSI concrete when necessary from bottom of footing to bottom of dry clean trench and of sufficient length (both below and on each side of the footing) to assure that there is no point loading on the pipe.

F. Sleeves shall be extended beyond the 45º plane of influence off the nearest bottom edge of any adjacent footing, which would otherwise impose structural loading on the pipe.

G. Pipe sleeves for underground sprinkler, or fire protection lines shall be provided with pipe sleeves as specified here-in, and shall have a minimum 2” annular space between the carrier pipe and the sleeve.

H. Annular space at all above grade pipe sleeve installations shall be properly sealed with water proof (non shrink) caulking material (or appropriate fire stopping material, when penetrated structure is fire rated).

I. Sleeves at “wet floor” penetrations such as in kitchens, laundry rooms, mechanical mezzanines, etc. shall be a minimum of Sch. 10, Type 304 stainless steel. Sleeve shall have a 2” wide, ¼” thick, Type 304 stainless steel flashing flange welded 360º around the body of the sleeve. Flange and clamping ring shall be of the same material as the sleeve. Length and size of sleeve shall be as required to provide a minimum ½” annular space and it must extend from bottom of the deck (or
slab) to 2” above the finished floor.

1. Seal between the sleeve and the concrete using a non-shrink grout which is produced for such use.

2. Seal annular space water tight and, which meeting faire stopping requirements when applicable.

3. In the absence of a water proofing membrane, provide minimum 18” x 18” size good type water proofing membrane over top of flange.

4. Sheet goods waterproofing membrane material: “Chloraloy”, or “NobleSeal TS” (as applicable) by the Noble Company, or approved equal. Product shall be installed according to the manufacture’s requirements.

3.30 Seal openings around pipes where penetrating walls, floors and partitions with material having a fire resistance rating equal to the fire resistance rating of the wall, floor or partition penetrated.

3.31 Install flexible connectors on each side of water pumps. Connectors need not be used for "in-line" circulators that are supported by the pipeline in which they are installed.

3.32 Drain piping from double containment piping systems, drip pans, overflows, relief valves, etc., shall be piped to nearest visible equipment or floor drain.

3.33 Insulating (dielectric) type unions shall be used whenever two dissimilar metals are being joined.

3.34 Tests and inspection shall be completed and approved by Engineer before covering or furring-in.

3.35 Valves shall be installed in all branch lines serving plumbing fixture(s), or more than one piece of equipment, and elsewhere shown on plans or specified herein. Also each piece of equipment shall be valved separately with the same size valve as the line in which they are placed so that equipment can be removed without shutting off the entire main. Mount valve with stem in or above horizontal position in an accessible manner.

3.36 Blow-off with 3/4" ball valve shall be installed in strainers one inch and larger. Install nipple and cap on valve discharge.

3.37 Drain fittings shall be provided at low point of pump volute, and elsewhere as required. Air vent required in volute and 1/4" flange taps for gauges. All air vents must be accessible.

3.38 Water Hammer Arrestors: Provided at the top or end of each fixture branch / header serving fixtures or equipment with quick closing valves / flush valves. Refer to drawings, when shown. Provide hinged (lockable) access door and frame as specified for access when located in chase).

3.39 Water service pipes or any underground water pipes shall not be run or laid in the same trench with building sewer or drainage piping.

3.40 Direct bury pre-insulated piping system shall be installed per manufacturer’s written installation requirements. Refer to civil drawings for additional requirements (i.e: Thrust Block Details, etc.). A minimum thickness of 24” of compacted backfill over top of piping shall meet “H-20” wheel loading when located in a paved drive or parking area.

3.41 Polypropylene Pipe and Fittings shall be installed per the manufacturer’s installation instructions.

3.42 Exposed pipe and fittings (i.e: at kitchen equipment, etc,) shall be chrome plated brass.

3.43 All supplies, hardware, trim, traps, etc., to fixtures and equipment shall be chrome plated brass, if exposed to view.
3.44 Installation and testing of the mechanically grooved (or pressed) copper fitting system shall be:
   A. Installed by trained and qualified workmen.
   B. Installed per the manufacture’s written installation requirements.
   C. O-ring seals on mechanically pressed joints shall be protected against elevated temperatures.

3.45 Piping located overhead, or above ceilings in kitchen, or commercial food service areas (including storage, dining areas, etc: Installations shall be concealed in walls, above ceilings, chases unless specifically indicated otherwise.
   A. Piping which would otherwise be exposed in food service areas: Concealed with custom fabricated, Type 316 stainless steel enclosure and caulked to wall, etc. using a silicone based caulk as specified in the general trades sections for food service work. Enclosure shall be securely anchored to building structure using Type 316 gauge stainless steel brackets and fasteners with appropriate inserts epoxied into block walls, floor slabs, etc. as required.
   B. Drainage Piping Located Overhead, or Above Food Service Ceilings: Provided with galvanized sheet metal drip pans (sloped with pipe) and a tell-tail drain piped to an acceptable location as indicated on drawings.

3.46 Galvanized pipe, fittings, or nipples: not be used on domestic water (or drainage) piping systems.

END OF SECTION 220503
SECTION 220504 - PIPING SPECIALTIES

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Sleeves through masonry walls shall be of black steel pipe. All invert and pipe centerline elevations shall be coordinated and finalized prior to setting sleeves. Contractor shall be financially responsible for required core drilling as result of sleeves not being coordinated with other trades and conditions on the site.

1.03 This section applies to all piping installed under this contract.

1.04 Sleeves through masonry walls shall be black steel pipes.

1.05 Sleeves through outside walls, underground, shall be cast iron sleeves with collar and annular space for caulking material to provide a watertight joint. Annular clearance between sleeve and any fire protection line shall be 2” clear.

1.06 Sleeves through concrete slabs shall be 16-gauge galvanized sheet metal extending 1-1/2" above floor where pipe will not be exposed. Annular space shall be caulked to top of sleeve.

1.07 Sleeves on floor of (or above) food preparation areas shall be 16-gauge stainless steel, cast in place. They shall extend 3" above floor. Annular space shall be sealed to top of sleeve with Thiokol compound.

PART 2 - PRODUCTS

(Note: When any of the following products are used in a potable water piping systems, the wetted surfaces shall contain a purposeful amount of lead equal to (or less than) 0.25% as defined by the updated NSF '61' as "Low Lead", regardless of description, model numbers used.)

2.01 Flexible Connectors (at equipment or pipe). Composition Neoprene and Nylon, with steel flanges, 150 psi rated, maximum 225 degrees F temperature. Like Metra Flex #100HT/711 or Mercer Flexmore style 450 N, NSF-61 Low Lead compliant.

2.02 Expansion Compensators (in line) water service. Stainless steel alloy bellows - 2-ply, ground joint union connections, 1-1/2" maximum travel. Like Metra Flex Model HP; Flexonics model H; Anaconda, NSF-61 Low Lead compliant.

2.03 Combination Temperature Pressure Relief Valves: Bronze body screwed connections, Watts #140 or 240 or approved equal, NSF-61, Low Lead; ASME approved and labeled for #125 working pressure.

2.04 Pressure Relief Valves: Bronze body, bronze/brass/stainless steel internals and Teflon or Buna-N O-rings, hand wheel, NSF-61, Low Lead; Kunkle Model 19, or approved equal.

2.05 Flexible Water Connectors for Potable Water Systems (at equipment, other than at pumps): NSF-61, Low Lead & ASME A112.18.6 Compliant, chloramine resistant tubing and washers, braded stainless steel construction, 160 PSI working pressure at 33°F to 140°F, chrome plated brass ends with applicable configurations. Size and length as required. Approved Manufactures: LSP Aquaflow Products, or approved equal.
2.06 Flexible Water Connectors (Potable Water Systems at Ice Makers): NSF-61, Low Lead & ASME A112.18.6 Compliant, chloramine resistant construction, 160 PSI working pressure at 33°F to 140°F, chrome plated brass 1/4” compression ends. Length as required. Approved Manufactures: LSP Aquaflow Products, or approved equal.

PART 3 - EXECUTION

3.01 Sleeves shall be installed during construction and provided for all pipe passing through floors, walls, slabs, or beams to allow pipe movement. Do not mortar in any pipe to building construction.

3.02 Sleeves are required for all piping which passes below (or adjacent to) footings and shall extend to beyond the zone of influence.

3.03 Piping accessories shall be installed in accordance with drawings or detail sheets or specific piping system specifications.

3.04 Provide union on each relief valve and T&P relief valve (in the vertical discharge pipe near the device).

3.05 Provide stainless steel flexible connectors at equipment having permanently fastened, removable components such as covers on grease reclaim drums for automatic grease interceptor and reclaim systems, etc.

3.06 Provide a pressure relief valve immediately downstream of each pressure regulating (or reducing) valve and pipe to nearest acceptable floor drain. Do not pipe reliefs to floor drains located in public restrooms.

END OF SECTION 220504
SECTION 220519 - GAUGES AND THERMOMETERS

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Pressure gauges and thermometers shall be furnished and installed complete as shown on the drawings and specified herein.

1.03 Submit descriptive literature and shop drawings for approval.

PART 2 - PRODUCTS

(Note: When any of the following products are used in a potable water piping systems, the wetted surfaces shall contain a purposeful amount of lead equal to (or less than) 0.25% as defined by the updated NSF '61' as "Low Lead", regardless of description, model numbers used.)

2.01 Pressure gauges shall be pressure, vacuum, or compound type as required to suit condition, liquid filled, 4” diameter; stainless steel case; guaranteed 1% accuracy; ½ " N.P.T. connection; glass; pressure dial range shall suit service with normal operating pressure in middle range of scale; Trerice #700, LFSS or equal.

2.02 Thermometers shall be light powered digital readout type, with ½” LCD digits, adjustable angle industrial design, nominal 6” long stem with brass thermowell, ⅜”, or 1”, or 1-1/4”-18 N.P.T. brass hex coupling nut, aluminum, (brass, or high impact ABS) casing, glass passivated thermistor, 1% accuracy, 1/10° resolution, update interval 10 seconds, 10 Lux rating, 0°F - 140°F ambient operating temperature range, zero ambient temperature error, 95% relative humidity (non-condensing); -40°F to 140°F operating temperature range; Trerice #SX9, or equal by Weiss Instruments, or Winters Instruments. See Part 3 for additional requirements based on installation requirements.

2.03 Test fitting to receive 1/8” o.d. temperature or pressure probe shall be solid brass with valve core of Neoprene. It shall be fitted with a color coded and marked cap with gasket and shall be rated at 1000 psig. Fittings, thermometers and gauge adapters shall be Pete’s Plug as manufactured by Peterson Engineering Co., Universal National or equal.

PART 3 - EXECUTION

3.01 Pressure gauges shall be installed using a ½” ball valve.

3.02 Instruments shall be installed so that they may be easily read from a position 60” above the finished floor.

3.03 When digital readout on a light powered digital thermometer is obstructed from normal view (or more than 10’ from a 5’-0” tall individual’s line of site while standing on a floor, or platform), it shall be provided with a temperature transducer and remote receiver and digital readout having similar parameters to those described above for the light powered digital readout thermometers.

3.04 Furnish and install thermometers in all water supply and return lines where they enter or leave the mechanical equipment room; on inlet and outlet of all heat transfer equipment, heat exchangers; and elsewhere as shown on the drawings.

3.05 Furnish and install pressure gauges in all inlet and outlet water piping which serves any piece of equipment or appliance having pressure drop; water filters (per vessel), water softeners (per vessel), etc. and elsewhere as shown on the drawings.
3.06 Thermometers:
   A. Installed in thermowells.
   B. Tee fittings shall be installed in lieu of elbows where thermometers are required.
   C. Thermowells shall be installed against the direction of flow in the through run of the tee fitting.

END OF SECTION 220519
SECTION 220523 - VALVES

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Piping systems are specifically described in other sections of this specification.

1.03 Install butterfly or ball valves for shut-off service in all water lines. Do not use gate or globe valves.

1.04 All valves used in PVC Piping System shall be of threaded type for 2" and smaller and flanged for 2-1/2" and larger.

1.05 Submit descriptive literature and shop drawings for approval.

A. Applicable requirements with-in this section applies to each technical section in the project manual and shall be considered as part of the technical sections regardless if it’s repeated within the technical section or not.

B. Product data and shop drawings shall be submitted by technical section and shall include all applicable requirements within this section as well.

C. Do not provide submittals for products (or material) under this section, unless there are no technical section(s) covering a specific system, or installation. Submittals under this section shall identify the system(s), or installation where the products are to be used. Provide additional information as warranted (ie: it’s intended use, etc.).

D. If material is covered under this section and not in a technical section, it shall be submitted as though it were covered in the technical section.

E. If methods and materials listed in this section and those in the technical sections are in conflict, the most stringent requirement shall apply. If differences are noted on the submittal, the engineer will consider the circumstances during the review process.

F. Where product data is submitted for material common to multiple technical sections, they may be combined into one submittal, providing the following criteria is met:

1. Like materials are being submitted for each section (ie: pipe and pipe fittings for storm and sanitary sections; or valves for the hot & cold water and compressed air systems, etc.). Gas and fire protection valves are to be submitted separately under their respective sections.

2. Commonly submitted products are to be identified for use by each section number and name and when more than one product listed and each shall be identified for use by the respective section names and numbers (ie: If Charlotte Pipe & Fittings were to be submitted with the intention of using PVC- DWV pipe & fittings for both storm and sanitary drainage systems and cast iron pipe & fittings to be used at high temperature drain locations on part of the sanitary drainage system, this information is to be conveyed on the submittal along with the name and number of each relevant section and the ASTM/ANSI numbers involved with each product).

1.06 Refer to Section 221616 for pertinent information regarding Gas Cocks.
PART 2 - PRODUCTS

(Note: When any of the following products are used in a potable water piping systems, the wetted surfaces shall contain a purposeful amount of lead equal to (or less than) 0.25% as defined by the updated NSF '61' as "Low Lead", regardless of description, model numbers used.)

2.01 Gate Valves (3" and larger) Domestic water main/incoming service line (AFF). Kennedy #7000, or approved equivalent by American-Darling, or Nibco #F-619-RW. AWWA C-515, AWWA C-550, NSF-61; 250# Rated, 100% bubble tight shut-off, non-rising stem, fusion bond epoxy coated ductile iron body with unobstructed waterway, fully encapsulated resilient wedge disc with twin seals, high strength/corrosion resistant bronze stem and trim, upper and lower thrust bearings, corrosion resistant nuts and bolts (stainless steel when located underground), stuffing box and bonnet with o-ring seals, triple seal o-ring seals at upper end of stem. The upper two o-rings above the upper bearing shall be able to be replaced under operating pressure. Valve ends, stem travel and operators to be provided as follows:

A. Buried underground installation: Kennedy #7571, Nibco #MJ-619-RW-SON etc. Non-rising stem valve with mechanical joint ends and 2"square operator nut. Provide an adjustable two piece screw type valve box, cover (labeled “Water”) and wrench (lengths as required).

B. In buried vault, or inside building (AFF): Kennedy #7561, Nibco #F-619-RW etc. Non-rising stem valve (unless water purveyor requires an outside stem and yoke valve - Kennedy #7561-OS&Y, Nibco #F-607-RW) with epoxy coated cast iron hand wheel operator and flanged ends.

2.02 Check Valves (2" and smaller pipe) steam, water, oil, or domestic water. Hammond #IB904, Milwaukee #509, Crane #1707, Nibco #T-413Y-LF. Class 125# SWP; horizontal swing check; ASTM B62 cast bronze body, internals and cap; threaded ends. MSS SP-71.

2.03 Check Valves (2-1/2" and larger pipe) steam, water, oil service and domestic water: Hammond #IR1124-HI, Milwaukee #F2974M, Crane #373, Nibco #F-938-33. Class 125# SWP; horizontal swing check; ASTM A126 cast iron body and bolted cap; bronze trim, flanged ends. MSS SP-71. Victaulic Series rolled groove swing check may be used in grooved piping systems.

2.04 Non-Slam Check Valves (Inclined Seat with Rubber Flapper): Storm water, wastewater, or sanitary pump vertical discharges. Val-Matic #100 Series, or approved equal; Class 125#, swing check with inclined 45ºseat, cast iron body with flanged (or threaded) ends, fused epoxy coated finish inside and outside, unobstructed waterway, bolted cover, reinforced rubber flapper assembly.

2.05 Butterfly Valves (2-1/2" and larger pipe) water service, domestic water service. Hammond #5211 Series, Milwaukee #CL Series, Crane #44 Series, Nibco #LD2000. 200# WOG; Full lug body of ASTM A126 cast iron, aluminum/bronze disc, stainless steel stem, EPDM liner, blow out proof stem with extended neck. MSS SP-67. Valves 6" and smaller: 10-position locking lever handle. Valves 8" and larger: weatherproof gear operator with hand wheel. Victaulic Series rolled groove butterfly valve acceptable for grooved piping systems.

2.06 Ball Valves (2" and smaller pipe) water service, domestic water service. Nibco #T-585-66-LF-HC. 600# WOG, Milwaukee, Crane; 2 piece lead-free bronze body with threaded ends, stainless steel ball, reinforced TFE seats, hex gland follower, blow-out proof stem, lever handle. MSS SP-110.

2.07 Drain Valves - Hammond #8501H, Milwaukee #BA100H, Crane #9211-HC, Nibco #T-585-66-LF-HC. 600# WOG; 2 piece bronze body with threaded ends, chrome plated standard port solid brass tunneled ball, reinforced TFE seats, hex gland follower, blow-out proof stem, lever handle, ¾” hose end with cap and chain. MSS SP-110
2.08 Shut-Off Cocks (Fuel Gas Piping Systems): See Section 221616.

2.09 Interior Hose Bibb

A. Unfinished areas: Rough brass, short pattern body with threaded end, with vacuum breaker, Woodford #24C or 24CP.

B. Finished areas: Polished chrome plated brass, wall flange, loose key operator with lockshield and integral vacuum breaker; Chicago Faucet #293-E27, or approved equal.

2.10 Backwater Valves (Duckbill: Variable Orifice Device) – Tideflex #TF-1, or approved equal; 100% elastomeric construction, with ply reinforcement; free from corrosion, wrapping, or freezing open, or closed; crack “open” pressure of less than two inches (< 2”) water column and; curved “duckbill” design shall be capable of sealing drip tight around debris and obstructions with less than 1 PSIG (or 2.31’ of head) backpressure; custom fabricated based on design flow and head pressure; slip on collar (or cuff) shall be sized for the individual pipe size and shall be secured in place by multiple 316 SS compression bands, flat bottom design minimizing bottom clearances. Valves shall have a minimum of 30 years operational life expectancy without required service, maintenance, or an external energy source. The curved ended, flexible, elastomeric buckbill shall be UV resistant.

2.11 Wall hydrants (non-freeze and mild climate types) shall have ¾” threaded connection, 45 degree angle hose connection with vacuum breaker; chrome plated recessed box type with loose key, Woodford #B65. Acceptable Manufacturers: Woodford, Jay R. Smith, Josam, Wade, Zurn

2.12 Thermostatic Mixing Valve (TMV): ASSE 1017, Bronze body, anti-scald thermostatic mixing valve with liquid (or wax) filled thermal motor, compensating for supply line temperature and pressure changes. Outlet flow shall be shut down completely or greatly reduced upon either hot or cold supply line (or liquid motor) failure. Inlets shall be provided with integral strainer-check-stops. Valve shall have tamper resistant, field adjustable temperature control with stainless steel piston liner, and shall be capable of being repaired in-line without being removed from the piping system. Acceptable Manufactures: Bradley, Lawler, Leonard (with Teflon coated port sleeve, thimble and bi-metal coil spring), or Stingray Systems.

A. An ASSE 1017 anti-scald thermostatic mixing valve shall be provided at each hot water source serving shower(s).

B. In the absence of an ASSE 1017 valve being present at the source of hot water, ASSE 1070 water temperature limiting device(s) shall be provided to temper hot water to 110ºF prior to supplying any plumbing fixture (other than showers).

2.13 Air Release Valves:

A. Automatic Air Release Valves: 175 PSI Max. W.P.: cast iron body; bronze (or stainless steel) trim; stainless steel float; BUNA-N seat; inlet sizes from 3/8” to 2” and outlet sizes from 3/8” to ¾” as required to exhaust designated amount of air as noted on drawings. Acceptable Manufactures: “Miniair” by Danfoss Flomatic; Watts, Taco, or approved equal.


2.14 Backflow Preventer Assemblies: Refer to Section 221116.

2.15 Pressure Reducing Valves: Refer to Section 221116.

2.16 Gas Valves: Refer to Section 221616.

2.17 Fire Protection Valves: Refer to Section 211313.
PART 3 - EXECUTION

3.01 Valves shall be installed in all branch lines serving more than one fixture, or piece of equipment and elsewhere as shown on plans or specified herein.

3.02 Each piece of equipment shall be valved separately with the same size valve as the line in which they are placed so that equipment can be removed without shutting off the entire main.

3.03 Mount valve with stem in or above horizontal position.

3.04 Blow-off with 3/4" ball valve shall be installed in strainers one inch and larger. Install nipple and cap on valve discharge.

3.05 Drain fittings shall be provided at low point of pump volute, and elsewhere as required. Air vent required in volute and 1/4" flange taps for gauges. Install in accessible location.

3.06 Install drain valves at all low points of water piping systems to facilitate drainage of systems.

3.07 Hot water mains and risers shall be circulated as indicated on the Drawings. The various branches and risers shall be provided with a balancing station to adjust the flow rate of circulation.

3.08 Vacuum breakers shall be installed with all faucets or valves equipped with hose connections, or fixtures that have inlets below the overflow rim.

3.09 Non-removable vacuum breakers shall be installed with all faucets or valves equipped with hose connections, or fixtures that have inlets below the overflow rim.

3.10 Provide wyre type strainer ahead of all thermostatic mixing valves and hot water return balancing valves (stations).

3.11 Air release valves shall be installed:
   A. In the top run of a full line size (or larger), up-flow tee.
   B. Plumb.
   C. Per manufacture’s installation requirements.
   D. When threaded outlets are provided, the exhaust / outlet shall be increased one pipe size and extended downward to the floor in an acceptable location so as not to create a nuisance or unsafe condition (ie: in corner of equipment room near floor drain, etc.).

3.12 Install isolation valves on both the suction and discharge side, and a check valve on the discharge side of any in-line or base mounted pump on the project, as well as a full size valved by-pass. Hot water return pumps shall have a full size by-pass valve assembly and a thermometer downstream of the by-pass tie-in on the discharge side of the pump.

3.13 Each wall hydrant and hose bibb shall be provided with an accessible shut-off valve ahead of such fixture.

END OF SECTION 220523
SECTION 220529 - HANGERS & SUPPORTS

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Approved hangers and stiff leg supports shall be installed in quantity and size as required to carry the weight of pipe, contents and insulation and shall be arranged to prevent vibration transmission to the building and allow for pipe movement.

1.03 Submit descriptive literature and shop drawings for approval.

1.04 Hangers and supports for fire protection systems shall be per Section 211313 and per Applicable NFPA Standards.

PART 2 - PRODUCTS

2.01 Hangers shall be supported by means of uncoated solid steel rods, which are threaded to allow vertical adjustments. Lock nuts shall be provided in sufficient number and location to lock all rod adjustments permanently at the adjusted height. Two lock nuts shall be used unless the nut tightens against a threaded socket. Minimum rod diameters shall be as follows:

<table>
<thead>
<tr>
<th>Nominal Pipe Size</th>
<th>Rod Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot; through 2&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; and 3&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>4&quot; and 5&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>8&quot; through 11&quot;</td>
<td>7/8&quot;</td>
</tr>
<tr>
<td>12&quot;</td>
<td>1&quot;</td>
</tr>
</tbody>
</table>

Fire Protection Piping Per Applicable NFPA Standard

2.02 Clevis hangers shall be like Anvil Figure 260.

2.03 Roller hangers shall be like Anvil, Figure 181.

2.04 Roller chair shall be like Anvil, Figure 175.

2.05 Support of hangers shall be by means of beam clamps attached to structural steel.

2.06 All hanger supports shall be swivel type allowing for pipe movement. Attach to top cord of open web bar joists.

2.07 All piping risers shall be securely supported at each floor level with clamp-on type support brackets and vibration isolators.

   A. Vertical Piping Supports shall be Anvil Figure 261 (Fig.CT121 for copper), or approved equal, tempered steel offset clamps at each floor level.

   B. Spring cushion hangers shall be installed on top and bottom of each pipe riser rising more than two (2) floors.

2.08 Hangers for exposed copper pipe shall be copper plated steel. Hangers for pipe other than copper shall be painted as specified in painting section of these specifications.
Two piece galvanized steel thermal pipe shields shall be used for all insulated pipe installed on rollers or hangers.


Piping subject condensation such as cast iron storm piping (in horizontal runs), domestic cold water piping, etc, shall be supported by oversized hangers around the outside of the insulation, with pipe shields and pre-molded support blocking used to avoid crushing of insulation. A pre-manufactured Polypropylene ‘V’ blocked, galvanized steel elevis hanger/saddle assembly by Anvil (#260 ISS) may be used in lieu of pipe shields and blocking.

Concrete or block supports shall be furnished and installed at the base of each soil, waste or storm water stack.

Horizontal piping located on roof shall be supported by pre-molded polymer pillow block style support assemblies having a roller sized for applicable piping and a slip sheet material glued to bottom of block (using a water proof adhesive) to protect roofing. Base shall be constructed in such a manner that it will not collect/retain rain water. Additional accessories or components to be used with the support assemblies shall be provided by the same manufacture. Acceptable Manufactures: “Miro Industries”, or “Roof Top Blox”.

When seismic bracing and/or restraints are required on a project, they shall be designed by a registered engineer specializing in such work over the last five years within the State of Indiana and in the four surrounding states. Certified submittals, calculations, part numbers and application drawings shall be submitted (identifying specific part numbers to be used for each application), etc. shall be submitted for the record.

**PART 3 - EXECUTION**

Hanger and support spacing shall be in accordance with the following:

A. Cast iron soil pipe shall be supported at each joint, but in no case shall hangers be spaced over 5'-0" o.c.

B. Steel pipe shall be supported: within 1'-0" of each lateral change of direction, with an additional support centered on perpendicular pipe when it exceeds 5'-0" in length; with a maximum spacing on straight runs in accordance with the following table:

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up through 3/4&quot;</td>
<td>7'-0&quot;</td>
</tr>
<tr>
<td>1&quot; through 2&quot;</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; through 4&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>6&quot; through 8&quot;</td>
<td>16'-0&quot;</td>
</tr>
<tr>
<td>10&quot; and larger</td>
<td>20'-0&quot;</td>
</tr>
</tbody>
</table>

C. Copper tubing shall be supported: within 1'-0" of each lateral change of direction, with an additional support centered on perpendicular tube when it exceeds 5'-0" in length; with a maximum spacing on straight runs in accordance with the following table:

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up through 1/2&quot;</td>
<td>6'-0&quot;</td>
</tr>
<tr>
<td>3/4&quot; through 1&quot;</td>
<td>8'-0&quot;</td>
</tr>
<tr>
<td>1-1/2&quot; through 2&quot;</td>
<td>10'-0&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; through 5&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>6&quot; and larger</td>
<td>14'-0&quot;</td>
</tr>
</tbody>
</table>

D. "No-Hub" cast iron shall be supported on each side of the joining sleeve.
E. Plastic pipe shall be supported at intervals not exceeding six feet (6') and not more than 18 inches from each joint.

F. Hanger shall be placed on the horizontal storm line, between each of the in-line fittings looking up vertically to the both the roof drain and to the overflows roof drain. In the event the storm drain and overflow drain runs laterally from the main, each branch shall have a dedicated hanger at base of each vertical drop from either the roof drain and/or the overflow roof drain.


3.02 Hanger rods shall not extend more than ½” below attachment point of hanger.

END OF SECTION 220529
SECTION 220555 – PLUMBING SYSTEM CLEANING

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Surfaces of equipment, piping, etc., installed by the Mechanical Contractor which are to be finish painted, or which have been exposed to the elements; and all equipment supports provided by the Mechanical Contractor, shall be thoroughly cleaned by the Mechanical Contractor of all scale, mud, rust, dirt, oil, grease, or other foreign substances.

PART 2 – N/A

PART 3 - EXECUTION

3.01 All bare pipe, hangers, valves shall be cleaned of dirt, grease, oil, rust, burrs and scale.
   A. Piping shall be flushed, prior to the cleaning process.

3.02 All duct work shall be cleaned on the exterior as well as the interior; all construction dirt shall be removed from the exterior of duct work fans and equipment.

3.03 The interior of ventilating equipment on all fan systems shall be cleaned with a vacuum cleaner. Systems shall be cleaned thoroughly before start up and before turning over to the Owner.

3.04 The exterior of all equipment shall be cleaned and be as new equipment before turning over to the Owner.

END OF SECTION 220555
SECTION 220700 - PIPE INSULATION

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Pipe insulation shall be installed as shown on drawings and specified herein.

1.03 Insulation thickness and type shall be as specified in paragraph 3.03 hereinafter. The type is described in Part 2.

1.04 Submit descriptive literature and shop drawings for approval.

PART 2 - PRODUCTS

2.01 Acceptable manufacturers are Owens Corning, Knauf, CertainTeed, Johns-Manville and Armstrong.

A. Rigid glass fiber pipe insulation shall be factory molded rigid type, .25 maximum K factor at 100°F. differential, and heavy density.

B. Vapor barrier jacket shall be Underwriters Laboratory rated noncombustible, flame retardant, fire resistant, vinyl coated and embossed vapor barrier laminate; like fiberglass ASJ.

C. Foam glass insulation shall be closed cell construction cellular glass, factory molded, 100 psi compressive strength, minimum density 9 pounds per cubic foot, maximum K factor of .55 at 300 degrees F. differential.

D. Foam plastic insulation shall be flexible closed cell construction, ozone resistant, minimum density 5 pounds per cubic foot, maximum K factor .26 at 75 degrees F. differential, maximum water vapor transmission of .1 perm per inch, and physically and chemically stable from -40 degrees to 220 degrees F.; like Armstrong, "Armaflex".

E. Polyurethane insulation shall be rigid closed cell construction, maximum K factor .16 at 75 degrees F. differential, maximum water vapor transmission of .02 perm per inch, nominal density 2.0 pounds per cubic foot. Install with factory applied vapor jacket; like Owens Corning, Armstrong Armalok, with ASJ Jacket.

F. Phenolic foam insulation shall be rigid closed cell construction, .23 K factor at 75 degrees F. differential, 2 lb. density, vapor transmission .02 perm per inch, like Armstrong Accootherm can be used whenever glass fiber is specified.

G. Sealants and adhesives shall be of composition and application as recommended by the insulation manufacturer.

H. All insulations shall be UL listed and shall have composite UL flame spread and smoke developed ratings not exceeding 25 and 50, respectively, as tested by ASTM E 84, NFPA 255 and UL 723 procedures. Accessories such as adhesives, mastics, cements, tapes, glass fabric, asbestos cloth, etc., shall have the same component ratings as the insulation.
PART 3 - INSTALLATION

3.01 GENERAL

A. Installation shall be made in accordance with manufacturers recommended procedure in a neat and workmanlike manner to the approval of the Architect / Engineer.

B. Furnish and use all mastics, adhesive and sealers as recommended by the manufacturer of the type of insulation installed.

C. All vapor jackets shall have butt and longitudinal joints overlapped (minimum 2" overlap) and sealed with adhesive.

D. Vapor barrier jackets shall be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces shall be adequately insulated and vapor-sealed to prevent condensation.

E. Miter end joints of pipe insulation at 45 degrees where insulation butts against pumps, fittings or equipment. Seal end of mitered insulation with recommended insulation sealer.

F. Insulation installed on work located in spaces subject to ambient temperatures below freezing shall be covered with twice the thickness of insulation specified for normal spaces.

G. Insulation installed exposed outside of building shall be twice the thickness specified for within the building and shall also have .016" thick aluminum protective jacket held in place with aluminum bands on maximum 18" centers, or with screws.

H. Insulation contractor shall replace with new and perfect work all insulation which is deformed, cracked, separated joints, sagging, dented, damaged, loose covering or tape, or otherwise presenting an unworkmanlike appearance at the time of final inspection.

3.02 PIPE APPLICATION

A. Factory molded glass fiber insulation shall be installed using minimum 4" wide adhesive strips on maximum 12" centers. All joints shall be sealed using waterproof sealer.

B. All valves, fittings, etc. in piping installations shall be insulated with mitered sections or factory made preformed fitting of the same material as that covering the pipe. Removable portions of valves, strainers, etc., shall be insulated in such manner that the removable parts can be serviced without disturbing the insulated body. Fittings covered with factory molded glass fiber insulation shall have additional PVC applied with adhesive and overlapping the adjacent pipe covering.

C. All end joints on pipe insulation shall have a 45-degree miter.

D. Piping within walls and piping within pipe chases and utility spaces shall be covered. All insulation shall be continuous through wall and ceiling openings and sleeves.

E. Insulation shall not be applied until lines are tested as specified with results approved by the Architect / Engineer.
F. Piping subject to condensation due to ambient conditions such as: copper and cast iron storm piping (in horizontal runs); horizontal runs of copper sanitary and condensate drain lines above ceilings (or overhead in finished spaces); cold and chilled water piping; etc. shall insulated and supported by oversized hangers around outside of the insulation. Provide pipe shields and pre-molded support blocking used to avoid crushing of insulation. Pre-manufactured Polypropylene “V” blocked, galvanized steel clevis hanger/saddle assembly by Anvil (#260 ISS) may be used in lieu of pipe shields and blocking.

G. Seal off pipe insulation of vertical pipe support at both sides of clamp with recommended sealer. Insulate clamp to proper thickness to prevent condensation and seal insulation.

3.03 INSULATION REQUIREMENTS

A. Insulate all new domestic hot and cold water piping with 1” thick glass fiber with vapor barrier jacket and PVC fitting covers.

1. Work shall include headers and individual supply and return piping on packaged (or skidded) systems such as water heater and booster pump packages. However, Armaflex may be used on packaged systems at the contractor’s discretion.

B. Insulate make up unit coil piping system with 1 ½ thick glass fiber with vapor barrier jacket and PVC fitting covers.

C. Insulate all new copper sanitary drain piping with 1” thick glass fiber with vapor barrier jacket and PVC fitting covers when: located in finished spaces; horizontal runs are located above ceilings.

D. Insulate all new condensate drainage piping located above ceilings and in finished spaces with 1” thick fiberglass insulation with vapor-proof jacket and PVC fitting covers.

E. Insulate underside of all roof drains, drain pans, all downspouts horizontal and vertical, with 1½” thick fiberglass insulation, ½” thick foam plastic may be used at horizontal downspouts and where vertical downspouts are concealed in walls or chases.

F. Insulate all PVC piping systems located within return air plenum spaces, including ceiling plenums and adjacent spaces which are open to ceiling plenums (such as Mechanical Rooms, open Chases, etc.) with foam plastic insulation having a developed flame/smoke spread rating which does not exceed 25/50.”

END OF SECTION 220700
SECTION 221116 - HOT & COLD WATER SYSTEMS

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Domestic water services shall be installed as shown on drawings and specified herein.

1.03 Refer to Basic Materials and Methods section of these specifications for material specifications, installation requirements and other equipment and requirements pertaining to this work.

1.04 Submit product data and shop drawings for review, as described below:
   A. Material submitted under this Section shall include additional applicable information listed under Section 220503 “Pipe and Pipe Fittings” (and Section 220523 “Valves” when applicable) as though they were part of this section.
   B. If requirements in the above referenced section(s) conflict with those in this section, the most stringent requirements shall apply.
      1. Conflicts shall be noted when product data is submitted for review and the engineer will review it at that time.

PART 2 - PRODUCTS

(Note: When any of the following products are used in a potable water piping systems, the wetted surfaces shall contain a purposeful amount of lead equal to (or less than) 0.25% as defined by the updated NSF '61' as "Low Lead", regardless of description, model numbers used.)

2.01 Water pipe, fittings and joints:
   A. Above ground pipe shall be copper Type L hard with wrought fittings and soldered joints; NSF '61', "Low Lead".
      1. Alternative Copper Pipe Joining Systems: Mechanically pressed system; rolled grooved system; NSF '61', "Low Lead".
   B. Underground Water Service Entrance shall be Pressure Class 350, ductile iron pipe and fittings; NSF '61', "Low Lead".
      1. Application commences a point beginning 5'-0" from the exterior building wall, to a point 12” above finished floor.
   C. Underground piping shall be copper Type K hard temper with wrought fittings and brazed joints; NSF '61', "Low Lead".
      1. Buried domestic hot water supply and return piping shall be a direct bury, pre-insulated copper piping system using Type K copper tube per Section 220503; NSF '61', "Low Lead".
      2. Pre-insulated PEX-a Piping may be used as an optional piping system for underground piping.

1.02 Valves:
A. Shut-off service shall be butterfly or full port ball type, per Section 220503; NSF '61', "Low Lead".

B. Flow check service shall be swing check type, per Section 220503; NSF '61', "Low Lead".

1.03 Wall hydrants shall be as referenced in the “Valve” Section and plumbing fixture schedule on drawings. Acceptable units are MiFab, Wade, Woodford, J.R. Smith, Josam, or Zurn.

1.04 Hose bibb shall be as referenced in the “Valve” Section and plumbing fixture schedule on drawings; NSF '61', "Low Lead". Acceptable units are MiFab, Woodford, J.R. Smith, Wade, Josam, or Zurn.

1.05 Each reduced pressure backflow preventer assembly shall consist of two shut-off valves, two separate spring loaded "Y" type check valves and one differential relief valve having two diaphragms separated by a spacer. The assembly shall automatically reduce the pressure in the "zone" between the check valves. Should the differential between the upstream and the zone to the unit drop to 2 PSI, the differential relief valve shall open and maintain the proper differential.

Both check valves and the differential relief valve shall be constructed so they may be serviced without removing the assembly from the line.

Backflow preventers 2” and smaller shall have bronze bodies and trim. 2½ and larger shall have cast iron bodies with internal epoxy coating and bronze trim rated to 175 PSI working pressure and water temperatures from 32 degrees F. to 140 degrees F.

Required Options: In-line strainer installed ahead of each backflow preventer; use of ball, or butterfly valves (if not standard); air gap fitting.

The assembly (with required options) shall meet the requirements of ASSE Standard 1013, AWWA Standard C506-78, and USC Foundation for Cross Connection Control and Hydraulic Research (USC-FCCC & HR); NSF '61', "Low Lead".

Assemblies shall be as scheduled on drawings.

1.06 Reduced pressure principle backflow preventer assemblies which are installed in the piping system upstream of a post mix carbonator and shall be of “lead free”, Type 316 stainless steel and plastic construction which shall be approved for use in potable water piping systems.

Caution: See “Part 3” for upstream and downstream piping at post mix carbonators.

The assembly shall meet the requirements of ASSE Standard 1013, AWWA Standard C506-78, and USC Foundation for Cross Connection Control and Hydraulic Research (USC-FCCC & HR); NSF '61', "Low Lead".

1.07 Water Hammer Arrestors (or Shock Absorbers): Tested and in compliance with Plumbing and Drainage Institute Drainage (PDI) “Standard PDI – WH-201”, permanently sealed yet flexible stainless steel bellows, which is suspended and free floating against a non-toxic vegetable oil, gas or an air cushion; NSF '61', "Low Lead".

A. Sized by PDI assigned fixture units (FU’s) for each size of unit.

1.08 Anti-scald protection shall be provided throughout the plumbing system through use of the following valves. See Section 220523 – “Valves”, for specifics and correct applications. Contractor shall assure that required protection is provided throughout the system in accordance with the Indiana Plumbing Code and Section 220523 of the specification. Valves shall have the following certifications: ASSE 1017 at the hot water source when showers are being supplied by the system, and ASSE 1070 at all other fixtures (other than showers if
there are no showers).

PART 3 - EXECUTION

3.01 Each wall hydrant shall have a shut-off valve located inside the building. Wall clamps shall be used to install hydrants.

3.02 All supplies, hardware, trim, traps, etc., to fixtures and equipment shall be chrome plated brass, if exposed to view.

3.03 ROUGH-IN’S AND PIPING SYSTEMS FOR POST MIX CARBONATORS:

A. All copper and brass pipe, fittings, valves, backflow preventers and appurtenances shall be thoroughly flushed completely clean of all dust and residue prior to serving any post mix carbonators to avoid the potential health risk of carbonic poisoning.

B. The only tubing downstream of post mix carbonators shall be reinforced plastic, etc. as determined by the equipment supplier.

C. Relief valve air gap fittings and discharge piping on a respective reduced pressure backflow preventer assembly shall be Type 316 stainless steel, or Schedule 40 PVC. The indirect relief valve discharge piping shall terminate above a PVC floor drain with a PVC strainer and funnel assembly. Waste and vent piping from floor drain shall be Schedule 40 PVC-DWV.

3.04 Piping system shall be capped and subjected to a static water pressure test of 50 psig above operating pressure (minimum 125 psig test) and maintained for 4 hours with no pressure loss. The test source shall be isolated and disconnected before pressure tests are conducted. The engineer or his representative shall witness test.

3.05 Test and submit six (6) copies of the test report for each backflow preventer installed on the project for review. Send copy of each test report for backflow preventers on incoming water service to the Owner and Water Purveyor. Testing shall occur after piping systems have been thoroughly flushed and strainers are cleaned.

3.06 Domestic water systems shall be flushed free of all foreign material prior to usage. Sterilization shall be performed in accordance with the Indiana Department of Health Rules and Regulations and the AWWA recommendations.

3.07 Install isolation valves on both the suction and discharge side, and a check valve on the discharge side of any in-line or base mounted pump on the project, as well as a valved full sized by-pass line. Hot water return pumps shall be controlled by aquastat and have a full size by-pass valve assembly and a thermometer downstream of the by-pass tie-in on the discharge side of the pump.

3.08 Installation of Water Hammer Arrestors (or Shock Absorbers):

A. Provide water hammer arrestors on each water line served by quick closing valves, solenoid valves, flush valves, etc.)

B. Provided at the top or end of each fixture branch / header serving fixtures or equipment with quick closing valves / flush valves / etc. Units placed at the end of the branch line shall occur between the supply lines to the last two fixtures on the branch.

C. Installations shall be vertical, plumb and accessible (regardless of manufactures’ claim of “no maintenance required”).
D. Provide hinged access door and frame when required for proper service access.

3.09 Use of galvanized pipe, fittings and nipples are prohibited.

3.10 Provide anti-scald throughout the system in accordance with the Indiana Plumbing Code and Section 220523 of the specification.

END OF SECTION 221116
SECTION 221123 – IN-LINE CIRCULATING PUMPS

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Pumps shall be furnished and installed complete as shown on drawings and specified herein.

1.03 Capacities shall be as indicated on drawings.

1.04 Submit descriptive literature, wiring diagrams and shop drawings for approval.

PART 2 - PRODUCTS

(Note: When any of the following products are used in a potable water piping systems, the wetted surfaces shall contain a purposeful amount of lead equal to (or less than) 0.25% as defined by the updated NSF '61' as "Low Lead", regardless of description, model numbers used.)

2.01 Pumps shall be single stage, close coupled or split case, wet or dry rotor design. The pump volute shall be all low lead bronze (or stainless steel) construction; motor housing shall be of aluminum.

2.02 Impeller shall be “Noryl” or equivalent. The impeller secured to solid motor shaft design. The motor shaft shall have stainless steel mounted thrust bearing.

2.03 Motor shall be ODP design with capacitor and thermal overload protection and shall require no scheduled maintenance.

2.04 Pumps shall be Armstrong "Astro" Series, Bell & Gossett “PL” Series (unless indicated otherwise), Grundfós, or Taco.

PART 3 - EXECUTION

3.01 Install as indicated and detailed on drawings.

3.02 Install isolation valves on both the suction and discharge side, and a check valve on the discharge side of any pump on the project as well as a full size (valved) by-pass line. Hot water return pumps shall be controlled by aquastat and have a thermometer downstream of the by-pass tie-in on the discharge side of the pump.

END OF SECTION 221123
SECTION 221313 – SOIL, WASTE & VENT PIPING SYSTEMS

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Furnish and install soil and waste piping systems as shown on drawings and specified herein (generally to a point 5'-0" outside of the building wall, unless noted otherwise).

1.03 Refer to Basic Materials and Methods section of these specifications for material specifications, installation requirements and other equipment and requirements pertaining to this work.

1.04 Excavating and backfilling of trenches required for the installation of all underground sewers, utility services and underground piping within the building shall be as specified in Section 019030.

1.05 Submit product data and shop drawings for review, as described below:

   A. Material submitted under this Section shall include additional applicable information listed under Section 220503 “Pipe and Pipe Fittings” (and Section 220523 “Valves” when applicable) as though they were part of this section.

   B. If requirements in the above referenced section(s) conflict with those in this section, the most stringent requirements shall apply.

       1. Conflicts shall be noted when product data is submitted for review and the engineer will review it at that time.

PART 2 - PRODUCTS

2.01 Soil, waste and vent pipe and fittings (atmospheric systems unless noted otherwise):

   A. Pipe and Fittings Underground:

       1. Polyvinyl chloride (PVC-DWV) schedule 40 rigid pipe ASTM D1785 and ASTM D2665 (pressurized). PVC pipe shall not be used where wastewater temperatures reach, or exceed 140°F.

       2. Service weight cast iron D-W-V pipe and fittings, meeting ASTM A74 with hub and spigot joints, using neoprene compression gasketed joints.

       3. Bored Pipe: IPS, Restrained Joint PVC pipe with integral bell, molded in o-ring seal and restrained joint spline design to be used for forced main pipe, or bored gravity sanitary drainage.

   B. Pipe and Fittings Above Ground:

       1. Polyvinyl chloride (PVC-DWV) schedule 40 rigid pipe ASTM D1785 and ASTM D2665. PVC pipe shall not be used where wastewater temperatures reach, or exceed 140°F. PVC pipe and fittings located within return air plenum spaces shall be covered with ½” thick closed cell foam insulation having a developed flame smoke spread rating of 25/50 or less, when tested to ASTM E-84. Cleanout plugs shall be provided and accessible at all changes in direction as prescribed in the Indiana Plumbing Code.

       2. Cast iron no-hub, or service weight D-W-V pipe and fittings for sizes 1-1/2" and larger.

       3. Copper DWV pipe and with wrought fittings, with brazed joints for sizes 2" and smaller may be used. Do not use copper in urinal drainage pipe.

       4. Condensate drain piping (from heat pumps, etc.) shall be trapped and shall terminate at a floor
drain (or receptor) with a minimum 1” air gap. Indirect waste pipe material may be of Type “L” copper, or Schedule 40 PVC-DWV pipe and drainage pattern fittings. PVC piping located within return air plenums (including mechanical rooms which may be an extension of the plenum) shall be covered with ½” thick closed cellular pipe insulation having a developed flame/smoke spread rating of 25/50 or less, when tested to ASTM E-84. Cleanout plugs shall be provided and accessible at all changes in direction as prescribed in the Indiana Plumbing Code.

C. Acceptable cleanout manufacturers: J.R. Smith, Josam, Wade, or Zurn.

2.02 Traps on cast iron pipe shall be service weight cast iron. Traps on threaded pipe shall be cast iron drainage pattern type. Exposed traps shall be chrome plated 17 gauge brass (or of same material of pipe when on acid waste piping systems). Traps on copper pipe shall be cast bronze. All traps shall have bottom cleanout plugs.

2.03 Cleanouts located in floor shall be set with top rim flush with top of floor slab with nickel bronze finish with scoriae top and taper threaded bronze plug seal, like J.R. Smith #4020 Series. Install cleanout covers with carpet marker in carpeted areas. Provide applicable recessed tops for tile and terrazzo floor finishes. Size of cleanout shall match that of the downstream pipe size (maximum of 6” inside the building, except for the building drain cleanout).

A. Acceptable cleanout manufacturers: J.R. Smith, Josam, Wade, or Zurn.

2.04 Cleanouts in walls shall be set behind finished wall and be covered with a separate screw fastened plate set flush with finished wall; taper threaded bronze plug seal. Round stainless steel wall plate and screw (length as required). Jay R. Smith 4452 and 4472 Series. Size of cleanout shall match that of the downstream pipe size (maximum of 6” inside the building, except for the building drain cleanout).

A. Acceptable cleanout manufacturers: J.R. Smith, Josam, Wade, or Zurn.

2.05 Grade (or Exterior) Cleanouts located on building drain shall be set in 24” x 24” x 10” thick concrete pad set flush with finished grade and are typically installed three feet outside of the building wall. Cleanout assembly shall have a separate heavy duty rated cast iron housing with two ring flanges and cover which is completely independent of the cleanout ferrule and plug portion: Jay R. Smith # 4253-S. Size of cleanout shall match that of the downstream pipe size (maximum of 8”).

A. Acceptable cleanout manufacturers: J.R. Smith, Josam, Wade, or Zurn.

2.06 Exterior Grease Interceptor: Precast concrete structure, surfaces sealed inside and outside with bituminous mastic, gasketed joints, with baffles and drop pipes, manhole frames and covers, precast concrete riser rings, pipe seals, etc. Refer to drawings for additional requirements and size.

2.07 Exterior Grease Interceptor: ASME A112.14.3 (type C): Constructed of rotationally-molded High Density Polyethylene with minimum 3/8” uniform wall thickness; lifetime guarantee; for above or below grade installation; anchor package; cover shall provide water/gas tight seal and have minimum 2,000 lbs load capacity; field adjustable riser system; built-in flow control; built in test caps and three outlet options. Flow rate and retention capacity shall be as scheduled on the drawings.

2.08 Acceptable Manufactures: Schier Products “Great Basin”; Proceptor by Green Tuttle; or an approved equal.

2.09 Air Admittance Valves (AAV): ASSE 1050 (Stack Type), ASSE 1051 (Single Fixture, or Branch Type), NSF Standard 14, IAMPO. Constructed of either Polystyrene, ABS, or flame retardant Polycarbonate resin with elastomeric membrane which operates by vacuum on the system and by gravity during no-flow conditions as a one-way valve allowing air to enter into the piping system to prevent siphoning of traps. Housing shall be designed in a manner to direct condensation back into the
drainage system. Screens shall be provided both on the inside and outside of the air inlet surfaces to protect against insects and debris. Adaptors shall be provided to accommodate required vent pipe sizes. Acceptable Manufacturers: Studor “Mini-Vent”, Studor “Tec-Vent”, or approved equal.

A. Provide poly constructed recessed rough-in box and chrome plated metal grille face plate secured in place with screws. Box shall be specifically designed and manufactured for use with the AAV and provided by same manufacture. Box and accessories shall be fire rated when located in a fire rated wall or chase.

PART 3 - EXECUTION

3.01 Sanitary sewer piping shall be pitched at not less than 1/4” per foot for piping less than 3” in size and 1/8” per foot for piping 3” and larger (unless noted otherwise).

3.02 Service weight cast iron piping systems located underground shall be provided with neoprene compression gaskets.

3.03 "No-Hub" cast iron pipe and fittings located above ground shall be provided with heavy duty, no hub coupling systems.

3.04 Extend building drains at least 5' from building before changing to outside pipe material and provide an exterior (grade) type cleanout a distance of 3’ from building wall.

3.05 Connection between copper tubing and cast iron hub shall be made by means of cast bronze sweat joint spigots. Connection between threaded pipe and cast iron hub shall be by means of tapped cast iron spigots.

3.06 Cleanouts shall be installed in soil and waste lines where shown on the drawings and as required by the Plumbing Code and/or field conditions. Cleanouts shall be provided at the base of each soil and waste stack (18” A.F.F.) and at intervals of 100' (total developed length) maximum distance in straight runs, at each change in direction and at the end of all branches.

3.07 Cleanouts shall consist of proper drainage fitting components and terminated with ferrule and brass countersunk (or scoriae) tapper thread plug and an appropriate housing and/or cover. Type of cleanouts shall be as specified for various types of installations, both in finished and unfinished spaces. Provide carpet rings or markers in carpeted floor areas and appropriately selected recessed covers with nickel bronze rims in floors having vinyl tile, terrazzo, or similar floor finishes.

3.08 Cleanouts shall be of the same size as the pipe, up to 6” pipe size. Pipe sizes 8” and above shall have 6” cleanouts, unless indicated otherwise. All cleanouts shall be so located as to provide easy rodding. Cleanouts, which are above inaccessible ceilings or other inaccessible areas, shall be installed behind/above access panels, or they shall be extended up through floor above and installed as floor cleanouts. All cleanouts shall be accessible. Cleanouts above kitchen (prep, cooking, storage, dining) areas shall be provided with flashing flange, extended up through floor above and installed as floor cleanouts.

3.09 All plumbing vents shall be increased to a minimum of 3” pipe size (unless noted otherwise), at least 24” below roof deck and shall be securely anchored to the building structure below roof. Extend vent increaser a minimum of 12” above roof. Vents through roof shall be flashed and counter-flashed with 4-pound sheet lead turned down inside vent and extending at least 18” under roofing. Flashing and counter flashing assemblies required to pipe size above 4” shall be like Elmdor/Stoneman, or approved equal.

3.10 Each fixture and piece of equipment requiring connections to the soil and waste system shall be equipped with a code approved trap. The trap shall be placed as near to the fixture as possible and no
fixture shall be double trapped.

3.11 Indirect waste piping shall be trapped and terminated at an acceptable indirect waste receptor as defined by the Indiana Plumbing Code. All indirect waste piping over 15’ in length shall vented through the roof to atmosphere (as required for sanitary vent piping systems). Note: venting for indirect waste piping shall remain separate from the typical sanitary vent piping system.

3.12 Pipe passing through building wall (above grade) shall be caulked watertight. Pipe passing through building (or vault) wall (below grade) shall be provided with a mechanical link type sealing assembly, like “Link-Seal”, or approved equal.

3.13 Soil and waste piping shall be plugged and subjected to a test of minimum 10 feet head water pressure and maintained for 4 hours with no leakage for each incremental section.

3.14 Building sewer or drainage piping shall not be run or laid in the same trench with water service pipes or any underground water pipes.

3.15 Where sewer and water lines run parallel and a minimum separation distance of ten feet cannot be maintained, the sewer shall be constructed of water works grade cast iron with mechanical joints.

3.16 Where sewer and water lines cross and the water line cannot be placed above or below the sewer with a minimum of 18 inches vertical clearance, the sewer shall be constructed of water works grade cast iron pipe with mechanical joints within ten feet of the water line.

3.17 Air Admittance Valves (AAV): Installed per manufactures installation requirements and shall be located where indicated on drawings.

3.18 Sanitary soil and drain line connections shall be made by rolling the lateral down and connecting to horizontal main drain at a 45° angle, when at all possible.
   A. Do not connect horizontally to (or into the top) of the main drain, unless it has been determined that the “rolled” connection can not physically be made at the main.

3.19 Refer to Section 220503 for installation requirements regarding restrained joint ISP PVC pipe when used as a bored sanitary line.

END OF SECTION 221313
SECTION 221315 - FLOOR DRAINS

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Furnish and install floor drains where shown on drawings and specified herein.

1.03 Submit descriptive literature and shop drawings for approval.

1.04 Part 3 of this Section includes this trade’s responsibility in coordinating floor drains with required floor slopes and parameters for establishing strainer elevation at floor drains. Plumbing contactor shall be present when floors are poured, to assure that his drains are set at the correct elevation.

PART 2 - PRODUCTS

2.01 Floor drains shall be as manufactured by J.R. Smith, Josam, Wade, or Zurn: Designation of type is found on floor plans and the plumbing fixture schedule on drawings.

PART 3 - EXECUTION

3.01 Drain structures shall be installed level at proper elevation within adjustment of the drain, and with frame parallel to building walls.

3.02 Drawings depict floor drains, shower drains, and trench drains in the following manner: Generically called out on foundation (or underground) piping plan as floor drain (or F.D.), etc.; specific type of drain called out on floor plan as “F.D. ‘A’”, etc.).

3.03 Floor drains located above grade shall be provided with flashing flange, clamping ring and sheet good type water proofing membrane, extending a minimum of 24” beyond the flashing flange (a full 360° around the drain body and flange).

   A. Sheet membrane material shall be “Chloraloy”, or ”NobleSeal TS” (as applicable) by the Noble Company, or approved equal. Product shall be installed according to the manufacturer’s requirements.

END OF SECTION 221315
SECTION 221413 - STORM DRAINAGE INSIDE BUILDING

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Furnish and install storm piping systems as shown on drawings and specified herein (generally to a point 5'-0" outside of the building wall, unless noted otherwise).

1.03 Refer to Basic Materials and Methods section of these specifications for material specifications, installation requirements and other equipment and requirements pertaining to this work.

1.04 Excavating and backfilling of trenches required for the installation of all underground storm drains, utility services and underground piping within the building shall be as specified in Section 019030.

1.05 Submit product data and shop drawings for review, as described below:

A. Material submitted under this Section shall include additional applicable information listed under Section 220503 “Pipe and Pipe Fittings” (and Section 220523 “Valves” when applicable) as though they were part of this section.

B. If requirements in the above referenced section(s) conflict with those in this section, the most stringent requirements shall apply.

1. Conflicts shall be noted when product data is submitted for review and the engineer will review it at that time.

PART 2 - PRODUCTS

2.01 Storm Water Pipe and Fittings (Atmospheric systems, unless noted otherwise):

A. Pipe and Fittings Underground:
   1. Polyvinyl chloride (PVC-DWV) schedule 40 rigid pipe ASTM D1785 and ASTM D2665 (Pressurized).
   2. Service weight cast iron D-W-V pipe and fittings, meeting ASTM A74 with hub and spigot joints, using neoprene compression gasketed joints.

B. Pipe and Fittings Above Ground:
   1. Polyvinyl chloride (PVC-DWV) schedule 40 rigid pipe ASTM D1785 and ASTM D2665. PVC piping located within return air plenums (including mechanical rooms which may be an extension of the plenum) shall be covered with 1/2" thick closed cell foam insulation having a developed flame/smoke spread rating of 25/50 or less, when tested to ASTM E-84. Cleanout plugs shall be provided and accessible at all changes in direction as prescribed in the Indiana Plumbing Code.
   2. Cast iron no-hub, or service weight D-W-V pipe and fittings.
   3. Copper DWV pipe and with wrought fittings, with brazed joints.

C. Acceptable manufacturers: A B & I, Charlotte, or Tyler.
2.02 Cleanouts located in floor shall be set with top rim flush with top of floor slab with nickel bronze finish with scoriae top and taper threaded bronze plug seal, like J.R. Smith #4020 Series. Install carpet rings in carpeted areas. Provide applicable recessed tops for tile and terrazzo floor finishes.
   A. Acceptable cleanout manufacturers: J.R. Smith, Josam, Wade, or Zurn.

2.03 Cleanouts in walls shall be set behind finished wall and be covered with a separate screw fastened plate set flush with finished wall; taper threaded bronze plug seal. Round stainless steel wall plate and screw (length as required). Jay R. Smith 4452 and 4472 Series.
   A. Acceptable cleanout manufacturers: J.R. Smith, Josam, Wade, or Zurn.

2.04 Grade (or Exterior) Cleanouts shall be set in 24” x 24” x 10” thick concrete pad set flush with finished grade and are typically installed three feet outside of the building wall. Cleanout assembly shall have a separate heavy duty rated cast iron housing with two ring flanges and cover which is completely independent of the cleanout ferrule and plug portion: Jay R. Smith # 4253-S.
   A. Acceptable cleanout manufacturers: J.R. Smith, Josam, Wade, or Zurn.

PART 3 - EXECUTION

3.01 Roof drains and overflow roof drains shall be installed in a sump receiver. Sump receiver and drain bodies shall be insulated to prevent condensation from forming.

3.02 Storm piping shall be pitched at a uniform slope of not less than 1/8” per foot, unless indicated otherwise on the drawings.

3.03 Service weight cast iron piping systems located underground shall be provided with neoprene compression gaskets.

3.04 "No-Hub" cast iron pipe and fittings located above ground shall be provided with heavy duty, no hub coupling systems.

3.05 Extend building drains at least 5' from building before changing to outside pipe material and provide an exterior (grade) type cleanout a distance of 3' from building wall.

3.06 Connection between copper tubing and cast iron hub shall be made by means of cast bronze sweat joint spigots. Connection between threaded pipe and cast iron hub shall be by means of tapped cast iron spigots.

3.07 Cleanouts shall be installed in storm lines where shown on the drawings and as required by the Plumbing Code and/or field conditions. Cleanouts shall be provided at the base of each stack (18” A.F.F.) and at intervals of 100' (total developed length) maximum distance in straight runs, at each change in direction and at the end of all branches.

3.08 Cleanouts shall consist of proper drainage fitting components and terminated with ferrule and brass countersunk (or scoriae) tapper thread plug and an appropriate housing and/or cover. Type of cleanouts shall be as specified for various types of installations, both in finished and unfinished spaces. Provide carpet rings or markers in carpeted floor areas and appropriately selected recessed covers with nickel bronze rims in floors having vinyl tile, terrazzo, or similar floor finishes.

3.09 Cleanouts shall be of the same size as the pipe, up to 6” pipe size. Pipe sizes 8" and above shall have 6” cleanouts, unless indicated otherwise. All cleanouts shall be so located as to provide easy rodding. Cleanouts, which are above inaccessible ceilings or other inaccessible areas, shall be installed
behind/above access panels, or they shall be extended up through floor above and installed as floor cleanouts. All cleanouts shall be accessible. Cleanouts above kitchen (prep, cooking, storage, dining) areas shall be provided with flashing flange, extended up through floor above and installed as floor cleanouts.

3.10 Pipe passing through building wall (above grade) shall be caulked watertight. Pipe passing through building (or vault) wall (below grade) shall be provided with a mechanical link type sealing assembly, like “Link-Seal”, or approved equal.

3.11 Piping system shall be plugged and subjected to a test of minimum 10 feet head water pressure and maintained for 4 hours with no leakage for each incremental section.

3.12 Building sewer or drainage piping shall not be run or laid in the same trench with water service pipes or any underground water pipes.

3.13 Where sewer and water lines run parallel and a minimum separation distance of ten feet cannot be maintained, the sewer shall be constructed of water works grade cast iron with mechanical joints.

3.14 Where sewer and water lines cross and the water line cannot be placed above or below the sewer with a minimum of 18 inches vertical clearance, the sewer shall be constructed of water works grade cast iron pipe with mechanical joints within ten feet of the water line.

3.15 Overhead, horizontal storm lines shall be supported with pipe hanger at each vertical down leader from roof drain(s) and overflow roof drains. Refer to Section 220529 – Hangers and Supports.

END OF SECTION 221413
SECTION 221423 - ROOF DRAINS

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Furnish and install roof drains and overflow roof drains, where shown on drawings and specified herein.

1.03 Submit descriptive literature and shop drawings for approval.

PART 2 - PRODUCTS

2.01 Adjustable roof drains (and overflow roof drains) shall be provided with enameled cast iron or aluminum dome, flashing clamp, adjustable strainer assembly, clamp ring and a conventional sump receiver with under deck clamp assembly, or a deck plate system with integral sumps as manufactured by Zurn Industries. Deck plate / sump receiver assembly shall be securely anchored to roof deck structure as recommended by the manufacture. Exterior water dam shall be provided on overflow roof drains (interior standpipes are not acceptable).

2.02 Drains shall be as manufactured by:
   A. J.R. Smith, Josam, Wade, or Zurn.
   B. Reference plumbing fixture schedule on drawings.

PART 3 - EXECUTION

3.01 Contractor shall refer to detail on architectural and structural drawings for required coordination with roofing contractor on installation of roof drains; and use all precautions and methods necessary for a waterproof installation.

3.02 Required cutting, patching, flashing, and repair of existing roof installations which are currently under warranty shall be performed by the roofing manufacture’s authorized roofing contractor, at the expense of the contractor performing new roof drainage under this section and its scope of work.

END OF SECTION 221423
SECTION 221616 – FUEL GAS PIPING SYSTEM

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Fuel gas piping systems covered in this Section shall include Natural Gas and LP Gas (or Liquefied Petroleum Gas) and shall be part of a fixed pipe building installation, limited to a maximum to (five) 5 PSIG when in a gas - air mixture within the flammable range (unless indicated otherwise up to a maximum of (ten) 10 PSIG for piping. Piping systems shall be installed as shown on the Drawings, as specified herein, and per the current Indiana Fuel Gas Code. Type of fuel and system operating pressures are defined on the drawings.

1.03 Refer to Basic Materials and Methods Section of these specifications for material specifications, installation requirements and other equipment and requirements pertaining to this work.

1.04 Contractor shall verify any and all requirements of the utility company and shall include in his bid any and all costs charged by the utility company to furnish and/or install the gas service. This shall include any cost for gas lines or equipment installed by the utility company and charged to the Owner.

1.05 Submit product data and shop drawings for review, as described below:

A. Material submitted under this Section shall include additional applicable information listed under Section 220503 “Pipe and Pipe Fittings” (and Section 220523 “Valves” when applicable) as though they were part of this section.

B. If requirements in the above referenced section(s) conflict with those in this section, the most stringent requirements shall apply.

1. Conflicts shall be noted when product data is submitted for review and the engineer will review it at that time.

1.06 Manufacturer’s instructions and requirements shall supersede any directive within this section, when such directive would violate conditions of product “Listing”, “Labeling”, or “Manufacturer’s Installation Requirements”.

PART 2 - PRODUCTS

2.01 Gas Pipe:

A. (Above Ground – Inside Building) shall be ASTM A-53, Schedule 40 black steel pipe inside the building. See Part 3 for protective coating requirements in corrosive areas and for type of joints.

B. (Above Ground – Outside Building) shall be ASTM A-53, Schedule 40 black steel pipe outside the building. See Part 3 for protective coating requirements in exposed weather and corrosive areas and for type of joints.

C. (Underground Inside Building) shall be a Corrugated Stainless Steel Tube (CSST), pre-sleeved with a black polyethylene material forming an annular space, capable of being vented through a ¼” threaded boss connection located above finished floor. Pipe shall be of continuous length with no joints or fittings below finished floor. Under floor fuel gas piping system shall be installed in compliance with NFPA 54, International Fuel Gas Code and the Uniform Plumbing Code. Acceptable Manufactures: TracPipe PS/PSII, or approved equal. ¼” Vent tube shall be extended to atmosphere and terminated at a 1” gooseneck with insect screen.

D. (Underground Outside Building) shall be:
1. ASTM A-53, Schedule 40 black steel pipe with factory applied spirally wrapped corrosion resistant coating and joints wrapped with field applied plastic tape (minimum 1/2 overlap) as required by pipe manufacturer. Provide additional application of a black asphalt type material coating at each joint to 18” above grade. (Alternate wrap - Republic X-Tru-Coat). See Part 3 for type of joints.

2. ASTM D-2513 high-density polyethylene (HDPE) SDR 11 for piping 4” and smaller and shall have heat fused joints. Provide an electrically continuous insulated #18 AWG yellow (0.040 inch diameter) copper tracer wire suitable for direct bury at all buried pipe locations with provisions for future expansion. Tracer wire shall terminate 12” above grade at each end of pipe. Piping system shall be provided with anodeless risers as required by pipe manufacture and per the current edition of the Indiana Fuel Gas Code.”
   a. Transition fittings shall conform with ASTM D-2513 Category 1, or ASTM F-1973 like George Fisher Central Plastics Pre-Bent or Flexible Anodeless Risers.

2.02 Unions shall be black malleable iron; minimum 150 psi water working pressure; female pattern, brass to iron seat; ground joint. Threaded joints shall be made up using Teflon tape (applied in with the leading edge of the tape in a tightening (or right hand) direction, in lieu of pipe dope).

2.03 Flanges & Gaskets: ASME B16.1, or ASME B16.20; With pressure ratings equal to, or greater than required by the designated system test pressures. Standard facings are acceptable. Where 150 LBS pressure rated steel flanges are bolted to Class 125 cast iron flanges the raised face on the steel flange shall be removed. Full flanged gaskets shall be used with the material selected compatible with both the ambient temperatures and the systems chemical composition of the gas without physical and chemical degradation of the gasket.

2.04 Gas Control Valves & Cocks: UL Listed “keyport”, or “eccentric plug” design valve for natural gas; ANSI 125 lb. (MSS Standard for ¾” size); 175 PSIG W.P. (“dead-tight” shut-off with forward trending pressure is 175 PSIG, and reverse trending pressure at 75 PSIG); Nitrile - Butadiene resilient plug seal; secondary seal formed by metal surface on the plug making contact to metal seat; o-ring stem seal; corrosion resistant, permanently lubricated bearings located in the upper and lower plug journals shall allow operation of the valve without use of lubrication; thermally applied thermoplastic seat coating; lever handle operator. Provide one operator wrench for each ten (10) gas cocks per size of operator wrench, and a minimum of one operator wrench per size/per project.
   A. Valve Sizes ¾” to 2”: Cast iron body; resilient seated bronze plug; and threaded ends.
      1. SMG Series 425 Eccentric Plug Valve, with Fig. 483 lever operator with lock-out provisions. Order No. 0075-425-S-1-RS51 through 0200-425-S-1-RS51, or approved equal by “Millecentric” Series #625 Eccentric Plug Valve by Milliken, and “Keycentric” Series 311 Eccentric Plug Valve by Keystone.
   B. Valve Sizes 2-1/2” to 4”: Cast iron body; resilient seated electroless nickel plated cast iron plug; and flanged ends.
      1. SMG Series 425 Eccentric Plug Valve, with Fig. 483 lever operator with lock-out provisions. Order No. 0250-425-F-1-RS51 through 0400-425-F-1-RS51, or approved equal by “Millecentric” Series #625 Eccentric Plug Valve by Milliken, and “Keycentric” Series 312 Eccentric Plug Valve by Keystone.
   C. Provide gas control valves specified above for boilers, water heaters, roof top unit, etc. within (6’) six feet of equipment.
2.05 Gas Sample Port, Blow-Off Valves, and Appliance Shut-off Valves (Sizes ¾” – 2”): UL Listed for LP and natural gas; 600 W.O.G. heavy duty, forged bronze body, full port ball valve with one piece stainless steel or bronze ball, Teflon seats, blow-out proof stem with two Teflon anti-frictional washers and two Viton o-rings; threaded ends. Acceptable Manufacturers: Legend Valve #T1004, Apollo Valve #80-100, or approved equal.

A. Provide a sample port upstream and downstream of each pressure regulator to allow pressure readings to be taken. Provide ¾” weld-o-let on top of pipe, nipple, sample valve, nipple, ¾” x ½” concentric reducer with ½” plug.

B. In the absence of a serviceable cap at base of dirt leg, provide at weld-o-let with 3” of the bottom of the dirt leg and a 1-1/4” full port blow-off valve with nipple and elbow turned down. Provide plug in bottom of the elbow.

C. Provide appliance shut-off valves specified above for food service equipment and similar domestic appliances at (or within (6’) six feet maximum, of) the appliance.

2.06 Gas Pressure Regulator: Positive lock-up style, lever / fulcrum design with internal relief valve (IRV) and vent (refer to Part 3 for piping of the relief vent); actual orifice size and final spring selection shall be confirmed by the contractor with the regulator manufacture (or his representative) based upon parameters listed below:

A. Upstream pressure.
B. Downstream pressure (set point).
C. Number and type of gas fired units being fed by the regulator:
   1. MBH Input/Each.
   2. Min./Max. Pressure range for each.
D. Any additional MBH Input for future use (if designated in the contract documents).
E. Total connected MBH Input (immediate and future use).
F. Total connected load (TCL) shall fall within 20% to 80% of regulator’s rated orifice and spring capacity.
G. 10% Lock-up pressure.
H. Set point occurring near middle of the spring range.
I. Distance from regulator to gas fired equipment.
J. Distance from regulator to any quick closing solenoid valves combined with pressure sensing devices used to detect and establish lock-out conditions during rapid shut down of gas fired equipment (ie: standby generators, etc.).
K. Installation location (inside, or outside).
L. Inlet / outlet ports on body section of regulator shall be sized as recommended by the regulator manufacture, or his representative.
M. Vent limiting devices are prohibited.
N. Contractor shall reconfirm final selection of the gas regulator with the manufacture of the regulator which he is planning to use, based upon the above (field verified) parameters. If the manufacture’s representative recommends a different style (or configuration) of regulator(s) based on project conditions, plan on providing the product per their recommendations and advise the engineer immediately, prior to submitting product data for final coordination. Engineer will review the recommendation and advise when to submit product data.
O. Acceptable Manufactures: Sensus 243 Series, or approved equal.

2.07 Overpressure Protection: Provide control monitoring method, using two lock-up style regulators (as described above) installed in series, when indicated on drawings.

2.08 Pipe Soffits and Shrouds
A. Stainless Pipe Shrouds: Pre-manufactured 20 gauge stainless steel shroud assemblies with No. 4 finish configured in both vertical and horizontal positions, with matching tees and ells, concealed corrosion resistant non-spark mounting hardware and fasteners capable of withstanding 100 LBS of uplift. Joints shall be butt joined with internal splice couplings and/or with male/female interlocking joints. Acceptable Manufacturers: Grice Soffit, Inc; In-Ex Systems, Inc.; or approved equal.

PART 3 - EXECUTION

3.01 All gas piping installations shall conform to Indiana Fuel Gas Code, NFPA Volume 54 and/or any other local or state codes and Ordinances covering these installations (including that of the gas purveyor).

3.02 Contractor shall be responsible for physically determining the operating pressure of all existing fuel gas piping systems which are being extended, or modified as part of this project. Contractor shall physically install an approved pressure gauge and/or manometer and record said pressures (under flowing, or residual conditions) at each existing regulator location.

3.03 Horizontal gas piping shall be installed at a uniform grade of not less than 1/4" in 15' to prevent traps. Drip legs shall be furnished and installed at all locations where condensate may collect. Grade pipe up from the outside of building.

3.04 Each gas connection to a gas-fired appliance or piece of equipment shall have a shut-off cock, union/flange, a drip leg and pressure regulator (and over pressure relief protection if required). Note: Pressure regulators shall be positive lock-up type, with relief vent piped independently to the atmosphere. Do not manifold relief vents together.

A. Regulators shall be installed per manufacture’s installation instructions and shall have a minimum of 5 pipe diameters of straight and unobstructed pipe without fittings, and a minimum of 10 pipe diameters of straight and unobstructed pipe without fittings on the downstream side.

B. Relief vent shall be provided for each pressure regulator and shall be routed as directly as possible to atmosphere, following the most direct route with minimum number offsets. Increase relief vent piping by one pipe size at the regulator, and then one additional pipe size for each additional 15 lineal feet (L.F.) of total developed length (TLD) for first three pipe segments, with each 90° ell to be counted as 10 L.F. of the T.D.L., when calculating the size of relief vent piping. CAUTION: DO NOT COMBINE, HEADER, OR MAINFOLD RELIEF VENT PIPING OF MULTIPLE GAS REGULATORS TOGETHER, OR TIE-IN TO EXISTING COMMON RELIEF VENT HEADERS. EACH NEW REGULATOR SHALL BE VENTED INDIVIDUALLY TO ATMOSPHERE.

C. Contractor shall make necessary preliminary regulator adjustments during start-up of each piece of equipment and then again as all of the pieces of equipment served by the regulator are operating at 100% full load.

D. If an external sensing style of regulator is utilized, the sensing tube shall be of type 316 stainless steel construction and shall be installed downstream of the regulator or any pipe fitting a minimum distance of 10 pipe diameters. Connection to gas line: Install (run x ¼” outlet sized) welded thread-o-let, drill properly sized hole, install a stainless steel dielectric fitting with ¼” NPT inlet and a 3/8” tube size outlet, 3/8” stainless steel sensing tube (length as required), with a stainless steel needle type tuning valve.

3.05 Apply graphite to make threads of pipe - do not use any pipe dope or cement to make up joints.

3.06 Joints (except underground and system pressures of 5 psi or greater) shall be screwed joints up to and
3.07 Changes in pipe size shall be accomplished by using concentric reducers.
   A. Bushings shall not be used in fuel gas piping systems.

3.08 Valve ends shall be threaded on screwed piping systems and flanged on welded piping systems.

3.09 Underground gas piping shall not be laid in contact with cinders or other soil of corrosive types.

3.10 Individual supply lines to each piece of equipment / appliance shall be extended full line size (as indicated on drawings) to within a maximum of 3'-0" from point of equipment/appliance connection, before reducing pipe size.

3.11 Piping shall be tested in accordance with the requirements of the utility furnishing the gas, Indiana Fuel Gas Code, and NFPA 54. If utility company has no specific testing parameters, the, piping shall be filled with dry air or an inert gas to a minimum pressure of 50 psig and maintained for not less than 24 hours with no pressure loss. The test source shall be isolated and removed from the piping system before pressure tests are conducted.

3.12 In the event test pressure is not sustained over the 24-hour period, test each joint with a heavy solution of non-corrosive soap and water for leaks, repair leaks and retest until successful.

3.13 Prior to commencing work on any fuel gas piping system, disconnect and purge contents from system to atmosphere in a safe manner, using an inert gas as required per the Indiana Fuel Gas Code.

3.14 Gas service shall enter the structure above grade in an expose occupied space as indicated on drawings.

3.15 Above ground piping located outside (or in areas subject to weather exposure) shall be wire brushed and cleaned, prior coating with rust resistant exterior primer and two coats of rust resistant enamel gloss yellow paint.
   A. Piping subjected to severely corrosive conditions inside (or outside of) buildings, such as atmospheres rich in chlorine, etc. shall be prepared as described above and protected as follows:
      1. Piping in corrosive atmospheres shall have a two part liquid epoxy paint applied per manufacture requirements and recommendations (including specific preparation requirements, etc.). Epoxy system shall be either: “3M Scotchkote Liquid Epoxy Coating #323” kit; “3M Scotchkote Fusion-Bonded Epoxy Coating #6233”, or an approved equal. See drawings for additional requirements.

3.16 Piping shall not be run in (or through) crawl spaces, unless specifically indicated on drawings.

3.17 Do not subject any portion of the piping system, or appurtenances to flooding conditions (based on 100 year flood plane).

3.18 Thread (joint) compounds shall be resistant to action of LP gas and any other chemical constituents of gases being conveyed though the piping system.

END OF SECTION 221616
SECTION 223000 - THERMAL EXPANSION TANK

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 System: Domestic Hot Water System.

1.03 Thermal expansion tanks shall be furnished and installed complete as shown on drawings and specified herein.

1.04 Installation shall comply with the manufacturers printed installation manual.

PART 2 - PRODUCTS

(Note: When any of the following products are used in a potable water piping systems, the wetted surfaces shall contain a purposeful amount of lead equal to (or less than) 0.25% as defined by the updated NSF ’61′ as "Low Lead", regardless of description, model numbers used herein).

2.01 Thermal expansion tanks shall be of the pre-charged, fixed FDA approved heavy-duty butyl diaphragm type design. Tank shall be designed and constructed specifically for use with potable hot water piping system and fitted with an NPT stainless steel connection and a 0.302”-32 charging valve connection to facilitate on-site charging of the tank to system requirements. Integral floor stand shall be integrated into the tank design for all tanks other than those for an in-line installation. Tank shall be constructed in accordance with the most recent requirements of Section VIII Division 1, of the ASME Boiler and Pressure Vessel Code and shall be stamped 150 PSI W.P.

A. Acceptable Manufactures: Wessels "TTA" Series, or equal by Amtrol, Armstrong and B&G.

2.02 Tank shall be fitted with a full size dielectric union, service connection with drain valve, and pressure gauge.

2.03 Tanks shall have a baked enamel factory finish.

2.04 Tanks shall be A.S.M.E. rated when total tank capacity exceeds the minimum volume as set forth by the State of Indiana.

PART 3 - EXECUTION

3.01 Provide ASME listed and labeled safety pressure relief valve at each tank installed in conformance with manufacturer and code requirements. Route discharge piping to floor drain and terminate with air gap.

3.02 Do not install isolation valve on supply pipe.

END OF SECTION 223000
SECTION 223116 - WATER SOFTENER EQUIPMENT-Multiplex Progressive Flow Units

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Furnish and install multiple progressive flow water softeners where shown on the drawings and as specified herein.

1.03 Refer to Basic Materials and Methods section of these specifications for material specifications, installation requirements and other equipment and requirements pertaining to this work.

1.04 Submit descriptive literature and shop drawings (including factory and field modifications for interface with the Owner’s Building Automation System) for approval.

PART 2 - PRODUCTS

Assembly shall comply with the updated NSF '61' "Low Lead" requirements, by having all wetted surfaces contain a purposeful amount of lead equal to (or less than) 0.25%, regardless of the description, or model numbers of components used.

2.01 Water softener shall be Aqua Systems Commercial Series, Culligan, or Marlow. See Drawings for series; number model; quantity and capacity of softeners and brine tank(s). Tank shall be steel or fiberglass construction, rated at 125 psi working pressure at 100°F operating temperature. Lower distribution system (for tanks less than 20” diameter shall be full flow non-clogging single point distributor. Lower distribution system for tanks greater than 20” diameter shall be full flow non-clogging hub and lateral system of approved design. Provide bedding and “premium grade” resin media.

2.02 Brining System for softener systems 5 cubic feet through 15 cubic feet shall be of a dry salt grid design (or combination liquid brine/dry storage design for softeners smaller than 5 cubic feet). Tank shall have a safety overflow system. Tank shall be at least “commercial” size for 5 cubic foot (or larger) softeners and shall be equipped with a float operated plastic fitted brine valve and allow for simple adjustment of the salt dosage without removing the brine valve. Tank shall be of injection molded seamless plastic construction for tank diameters less than 30” and rotational molded seamless plastic for tank diameters 30” and larger, with cover.

2.03 Main Operating Valve and appurtenances on each softener, meters, etc. shall be of lead free brass construction. Valve shall have motor driven piston (or multi-port) type slow opening and closing and shall be free of water hammer. Valve shall be equipped with an automatic self adjusting brine injector to draw in brine and rinse at a constant rate regardless of water pressure in the range 20 to 125 psi. Each valve shall have ports with factory installed brass pressure gauge and sampling valve on the inlet and outlet of each resin tank.

2.04 Regeneration Sequence shall be fully automatic and in the following order: Backwash, Brine draw, slow rinse, fast down-flow flush, return to service and brine tank refill.

2.05 In-line Flow Meter shall be a turbine type meter with +/- 5% accuracy, capable of transmitting totalized flow signal back to the softener controls. Operating voltage shall be matched with the softener controls. Meter shall be full line size and placed on the outlet pipe of each softener vessel. Construction shall be brass or stainless steel with threaded or roll grooved ends, and shall incorporate an integral flow straightener. Additional lengths of cable shall be provided as required.
A. Service flow range of each meter (may vary slightly by manufacture), but in general: 0.5 to 60 GPM for 1-1/2” meters; 1-1/2” to 150 GPM for 2” meters.

B. Maximum pressure drop for each meter: 1-1/2” meter is 2.7 PSI at 75 GPM; 2” meter is 1.0 PSI at 150 GPM.

2.06 Acceptable Manufacturers are: Aqua Systems, Culligan, Marlow, and Enting Water Conditioning.

A. Air operated control valves shall not be used on well water systems.

2.07 Miscellaneous

A. Vacuum Relief Valve: Lead free brass body, ¾” NPT inlet valve body capable of 15 CFH venting capacity, internally guided and protected stem and diaphragm, tested to ANSI Z21.22.

1. Acceptable Manufactures: Watts #LFN360, or approved equal.

PART 3 - EXECUTION

3.01 Water Testing Set shall be furnished for hardness test.

3.02 Provide a vacuum relief valve on the inlet piping of each fiberglass softener vessel.

3.03 Provide union/flange on each inlet and outlet connection and at each flow meter.

3.04 Brine refill supplies shall be fed from the soft (or treated) side of the equipment when iron is identified as being one of the primary reasons for treating the water.

3.05 Brine overflow shall be piped to the nearest floor drain and terminated with a minimum 2” air gap. Drain shall either be hard piped (or zip tied if flexible tubing is used).

3.06 Meters shall be installed in the horizontal position with flow arrow (located on the side of the meter body) pointing in the direction of flow.

3.07 Instruction and "Start-Up": A complete set of operating instructions covering the installation, care and operation of the softener system shall be furnished bound in booklet form.

3.08 Mechanical Contractor shall provide for the service of a competent supervising engineer from the water softener manufacturer to: Inspect the completed installation; Assure that the flow controls are installed; Start the water softening system in operation; and train the operators with the proper operation and care of the equipment.

3.09 Salt Fill shall be provided in quantity required for initial fill up and brine tank shall be refilled after start-up and testing.

3.10 Electric Wiring for Controls: the responsibility of softener supplier, except power feeders will be provided as part of Division 26 Work.

3.11 Provide a full pipe sized, manual, 3-valve by-pass at all water treatment installations.

END OF SECTION 223116
SECTION 223450 – DOMESTIC WATER HEATER

PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Provide a “gas fired tank type water heater” as specified within this section, per the “Plumbing Equipment Schedule” as indicated on the drawings.

1.03 Acceptable Manufacturers are: Lochinvar or an acceptable equivalent by A.O. Smith and Bradford White

1.04 Submit descriptive literature, wiring diagrams and shop drawings for approval.

1.05 Manufacture’s “Certification” of compliance to all reference Standards shall accompany products submitted for review. Refer to Section 019000.

PART 2 - PRODUCTS

Assembly shall comply with the updated NSF '61' "Low Lead" requirements, by having all wetted surfaces contain a purposeful amount of lead equal to (or less than) 0.25%, regardless of the description, or model numbers of components used.

2.01 Water Heater:

A. Tank Construction: High strength steel, glass lined interior and fired to 1600° F to ensure a molecular fusing of glass and steel; In accordance with standard construction requirements tank shall be designed to withstand a hydrostatic test pressure of 300 PSI without leakage; working pressure of 150 psi; with magnesium anode to provide electrolytic protection; three (6) year limited tank and parts warranty. ASHRAE/IES 90.1 compliant.
   1. Controls: Include electronic ignition system comprised of thermopile pilot, internal microprocessor temperature control with LED status indicator, and ASME temperature and pressure relief valve.
   2. Water Heater: Approved to provide 140° F water for residential and commercial operation; Flammable Vapor Ignition Resistant burner with stainless steel flame arrestor plate with safety thermal switch to protect from lint and dust buildup; Low NOx Burner to reduce emissions.

B. Tank Jacket: Completely encase the tank and shall contain up to 2" of high density non-CFC polyurethane foam insulation to maximize heat retention and lower standby heat loss; Exterior jacket assembly shall be finished in a 3-coat acrylic enamel finish.

C. Exhaust Vent:
   1. 4” natural draft B-Vent.

PART 3 - EXECUTION

3.01 T&P and Safety Relief Valve Installations: Provide union on discharge pipe within 12” of valve and terminate discharge pipe at nearest floor drain/acceptable receptor using a 45 degree end cut (beveled back toward wall, or away from pedestrians).

3.02 Thermal expansion tank shall be installed as indicated on drawings. Tie-in point shall be located on
the cold water line, immediately prior to tie-in point on the water heater (package) piping and downstream of the contractor installed isolation valve. Install a union at the thermal expansion tank. **DO NOT INSTALL ISOLATION VALVE ON BRANCH LINE SERVING THE THERMAL EXPANSION TANK.**

3.03 Contractor shall provide thermometers on:

A. The outlet of the storage tank.

B. Each inlet and the outlet piping at the thermostatic mixing valve.

C. Each main system supply line leaving the water heater (when not covered by one of the above locations).

D. Each hot water return line (at the pump location).

3.04 Install a full CW pipe size x 30” long heat trap adjacent to storage tank and before CW piping at thermostatic mixing valve.

3.05 Refer to Section 221313 for gas piping and regulator requirements.

END OF SECTION 223450
PART 1 - GENERAL

1.01 Work shall include that which is indicated in Section 019000, and related Subsections 019010, 019020 & 019030 as if they are repeated within this section.

1.02 Furnish and install a complete plumbing system as shown on the drawings and specified herein.

1.03 In order to establish a degree of acceptable quality, manufacturer's model numbers are specified with each item on the Plumbing Fixture Schedule as standard of quality only. Other equal manufacturers are as follows:
   B. Stainless Steel Sinks: Elkay, Just, Kohler and American Standard or approved equal.
   C. Wash Tubs & Mop Basins: Fiat, Florestone, Mustee, Stern Williams, Swan or approved equal.
   D. Electric Water Coolers and Drinking Fountains, "Low Lead": Elkay, Oasis, Halsey Taylor, Acorn, or approved equal.
   E. Toilet Seats: White, open front, elongated seat, self sustaining check hinges with stainless steel hinge posts by Beneke #527-SS, Bemis, Centoco or approved equal.
   F. Flush Valves; "Low Lead": Sloan “Sloan-DFB with skirted vacuum breaker”, or Zurn.
   G. Faucets, NSF-61, "Low Lead":
      1. Lavatories: Zurn Commercial “Aqua-Spec” (with pop-up button permanently and neatly epoxied into place at the factory), Delta Commercial Faucet (or HDF/TEK), American Standard, Moen Commercial, or Grohe, as scheduled on drawings.
      2. Sinks: Zurn Commercial “Aqua-Spec”, Delta Commercial Faucet (or HDF/TEK), or Grohe, as scheduled on drawings.
      4. Provide an ASSE 1070 mechanical mixing valve at each plumbing fixture when the hot water source (at water heater) is not protected with an ASSE 1017 thermostatic mixing valve.
         a. Each single shank faucet, or sensor operated faucet shall also be provided with an ASSE 1070 mechanical mixing valve (for tempering purposes), regardless of whether an ASSE 1017 thermostatic mixing valve is located at the source or not.
   H. Carriers, Floor Drains, Cleanouts, Roof Drains, Wall Hydrants: J.R. Smith, Wade, Josam, or Zurn.
   I. Water Supply Stops and Risers: (Heavy Duty, Loose Key with Lock Shields), "Low Lead": Chicago Faucet, McGuire or Zurn.

1.04 Equipment designated on drawings indicates that items are to be furnished and installed as a part of the plumbing work.

1.05 Setting of Temperature Limit Stops: Contractor shall be responsible for setting the temperature limit stops on all lavatories, sinks and shower valves to 110°F, at completion of the project. Digital thermometers shall be used to verify temperature as the settings are being made.
PART 2 - PRODUCTS

(Note: When any of the following products, or appurtenances are used in a potable water piping system, the wetted surfaces shall contain a purposeful amount of lead equal to (or less than) 0.25% as defined by the updated NSF '61' as "Low Lead", regardless of description, model numbers used.)

2.01 WATER CLOSETS

A. White vitreous china - siphon jet action – 1.6 gallon per flush - elongated wall hung bowl – 2-1/8” fully glazed trapway - 1-1/2” top spud – factory flush test of the entire fixture. MaP Score: 1,000 grams of miso @ 1.6 GPF. Carrier as required for fixture. Provide flush valve conversion kit for retrofit closets, to avoid water rough-in modifications. White open front seat with stainless steel, self-sustaining, check hinges.

2.02 LAVATORIES (except Multi-Station type)

A. White vitreous china - front overflow – for concealed carrier arms, 4” centers, heavy duty chrome plated loose key supply stops with lock shields and risers, 17 gauge (tailpiece and 1¼” chrome plated adjustable P-Trap with bottom cleanout plug and perforated grid drain and return arm bend). Provide floor mounted carrier as required for fixture. Solid cast brass bodied faucet with polished chrome plated finish, single lever handle, temperature limit stops, less pop-up hole, 1.0 GPM - PCA laminar flow device (like “Neoperl” or approved equal), ADA compliant. Additional product requirements are found in Part 3.

B. In the absence of an ASSE 1017 thermostatic mixing valve at the water heater, provide an adjustable, chrome plated brass ASSE 1070 temperature limiting device with inlet check-stops at each hand washing fixture (or group of fixtures, per the design intent of the manufacture). All supply tubing, fittings, and connections shall be of polished chrome plated brass construction.

2.03 SINKS

A. Stainless steel – self-rimming – 18-gauge nickel bearing stainless steel with sound deadening material on underside, punched to match faucet and trim. “Faucet: Solid cast brass body with polished chrome plated finish, single lever handle, temperature limit stops, 1.0 GPM laminar flow spout end, ADA compliant.” Additional product requirements are found in Part 3.

2.04 MOP BASIN

A. Stain proof 24” x 24” molded-stone mop basin, drain body plate 3” I.P.S. outlet. 30” flexible hose and hose bracket, vinyl bumper guard, 302 stainless steel mop holder with 3 brackets. Provide silicone sealant for sealing around sink unit at wall and floor. Faucet: wall mounted with pail hook and angle support brace, adjustable 8” centers, integral check stops, atmospheric vacuum breaker, chrome plated finish.

2.05 ELECTRIC WATER COOLERS WITH BOTTLE FILLER

A. 14 Gauge Stainless steel bowl and cabinet with factory polished finish, or steel cabinet with factory applied powder coated finish as noted on plumbing fixture schedule. Units shall be furnished with bottle filler with automatic sensor dispenser.

B. ADA compliant water coolers and drinking fountains shall be provided with a matching cane strike apron for cabinets with leading edge above 27” AFF and it projects more than 4” into the accessible route.

C. Provide carrier as required for each fixture.
D. Reference plumbing fixture schedule.
E. Additional product requirements are found in Part 3.

2.06 HOSE BIB
A. Reference Section 220523 Valves and Plumbing Fixture Schedule.

2.07 NON-FREEZE WALL HYDRANT
A. Reference Section 220523 Valves and Plumbing Fixture Schedule.

PART 3 – EXECUTION
(Note: When any appurtenances are used for rough-in, or when making final connections to products used on a potable water piping systems, the wetted surfaces shall contain a purposeful amount of lead equal to (or less than) 0.25% as defined by the updated NSF '61' as "Low Lead").

3.01 Each water connection shall have heavy pattern, chrome plated brass, loose key supply stop(s) with lock shield(s) and chrome plated, semi-rigid, copper tube supply riser(s) with matching escutcheons at each fixture.

3.02 Each waste line shall be properly trapped at or near the fixture using code-approved traps with bottom cleanout plug. Exposed traps and waste arms shall be adjustable, chrome plated, cast brass construction with matching escutcheons. All continuous waste and similar waste tubing shall be of 17 gauge chrome plated brass construction.

3.03 Provide a white manufactured tubular insulation wrap on all exposed waste piping, P-trap, waste arms, water supply risers and stop valves on all handicap accessible lavatories and sinks.

3.04 All wall hung fixtures shall be supported from floor mounted carriers, with each support foot securely bolted to floor slab/structure. Provide additional supports as required for each fixture and/or piece of equipment.

3.05 After piping systems have been thoroughly flushed throughout the facility, remove and clean all filter media and screens, aerators, filtering media in each eyewash outlet (or supply line), strainer screens and baskets, etc.

3.06 Upon competition of installation, each plumbing fixture shall be filled with water. All supply stops, joints and connections shall be checked for leaks or retarded flow from faucet and through the drain assembly. Perform this procedure using hot water, and then using cold water. Repair all leaks and re-test using hot (then cold) water again to assure that all leaks are fixed and all obstructions are cleared.

3.07 Clean all exposed metal surfaces of grease, dirt, or any other foreign matter. Polish chrome plated piping, fittings and trim. Fixtures shall have labels removed and be cleaned according to manufacturer's specifications. Protect fixtures from injury until final acceptance.

3.08 Caulk around all wall hung (and floor mounted) fixtures using a non-hardening, non-yellowing, Dow silicone material in a neat and workmanlike manner. Each fixture edge shall be neatly caulked to adjacent wall/floor surfaces.
A. Floor mounted water closets shall be caulked to the floor, with a 2” long open relief gap at back of the fixture.
B. Color of caulking:
   1. China or white molded stone fixtures: “White”
   2. Other fixture colors: Verify with architect.

END OF SECTION 224000
SECTION 23 05 00 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 Furnish and install all materials, supplies, labor, equipment, tools, transportation, facilities and services necessary for, and required in connection with, properly incidental to the work as shown on the Drawings and/or specified herein or reasonably implied therefrom.

1.02 ASME Certificates: Submit to the Architect an ASME Certificate for each pressure vessel, which is specified to be constructed, and stamped, in accordance with ASME requirements.

1.03 Qualifications of Installers: For the actual fabrication, installation and testing of the work in these Mechanical Sections use only thoroughly trained and experienced personnel, who are completely familiar with the requirements for this work, and with the installation recommendations of the manufacturers of the specified items.

1.04 In acceptance or rejection of installed mechanical system, no allowance will be made for lack of skill on the part of installers.

1.05 Codes and Standards: All work shall conform to the Rules and Regulations of the Uniform Plumbing Code, Uniform Mechanical Code, and any other State or Local Codes and Ordinances covering these installations.

1.06 All materials shall bear the manufacturer's name, trade name and the UL or ASME label in every case where a standard has been established for the particular material.

1.07 Parts of the work governed by the section shall comply with the latest editions of the following applicable standard specifications and codes; for other standard specifications that if included by reference, see Division 1 of the Specifications.

ASME American Society of Mechanical Engineers
ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
ACRI Air Conditioning and Refrigeration Institute
ASTM American Society of Testing Materials
ASA American Standard Association
AWWA American Waterworks Association
NFPA National Fire Protection Association
IBR Institute of Boiler and Radiator Manufacturers
AMCA Air Moving and Conditioning Association
UL Underwriters' Laboratories
NEMA National Electric Manufacturer's Association
NEC National Electric Code
SMACNA Sheet Metal and Air Conditioning Contractor's Association
BOCA Building Officials and Code Administrators
IAPMO International Association of Plumbing and Mechanical Officials
FM Factory Mutual
USC-FCCC&HR University of Southern California – Foundation for Cross-Connection Control & Hydraulic Research

1.08 Local Building Code: Include all items of labor and material required to comply with such codes in accordance with the Contract Documents. Where quantities, sizes or other requirements indicated on the Drawings or herein specified are in excess of the code requirements, the Specifications and/or Drawings shall govern, regardless of code requirements.
1.09 **Welding:** Pipe Welding shall be welded by A.S.M.E. certified welders, and the procedure outlined in Chapter 4, Section 6, "Welding of Pipe Joints", of the American Standard Code for Pressure Piping (ASA B31, 1-1951) shall be followed; each welded joint shall be identified with the stamp of the operator performing the weld as provided for in the certification procedure.

Before any piping welding is performed, the Contractor shall submit to the Architect a copy of his welding procedure specifications together with proof of its qualification as outlined and required by the most recent issue of the code having jurisdiction.

1.10 Before any operator shall perform any pipe welding, the Contractor shall also submit to the Architect, the operator's qualification record in conformance with the provisions of the code having jurisdiction, showing that the operator was tested under the proven Procedure specification submitted by the Contractor.

1.11 Standard Procedure Specifications and operators qualified by the National Certified Pipe Welding Bureau shall be considered as conforming to the requirements of these specifications.

1.12 Contractor shall be responsible for the quality of welding done and shall repair or replace any work not in accordance with these specifications.

1.13 Piping systems shall be tested for ANSI/NFPA Z223.1 for fuel gas systems and ASTM B31.9 for all other building service piping systems, unless indicated otherwise in specific system sections.

**END OF SECTION 230500**
SECTION 23 05 03 - PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.01 This Section applies to all piping installed as a part of this Contract.
1.02 Piping Systems are specifically described in other sections of this specification.
1.03 Pipe sizes indicated herein or on the Drawings, refer to the nominal inside diameter.
1.04 Submit descriptive literature and shop drawings for approval.

PART 2 - PRODUCTS

2.01 PIPE MATERIAL

A. Black steel and Hot-Dipped Galvanized - ASTM specification - A120 welded fabrication or seamless.
B. Copper Pipe Type K, or L - ASTM specification - B88.
C. Pipe sizes indicated herein or on the Drawings unless otherwise noted, refer to the nominal inside diameter.

2.02 FITTINGS

A. Malleable Iron Screwed - Black or Hot-Dipped Galvanized - ANSI specification - B16-3 (150 and 300 PSI pressure rated).
B. Butt Weld, factory made Wrought Steel - ANSI specification - B16.9.
C. Socket Weld, Forged Steel - ANSI specification - B16.11.
D. Copper, Wrought - ANSI specification - B16.22. (Field insulated, per the pipe manufacturers written installation requirements.)
E. Grooved Type:
   1. Malleable Groove Type - ASTM A47.
   2. Ductile Groove Type - ASTM A536.
   3. Cast Iron Groove Type - ASTM A48, Class 30-A.
F. Fittings shall, in all cases, match the pipe to which they are joined and shall be suitable for the service intended.
G. Fittings in lines 2" or smaller shall, in general, be screwed and those in lines 2-1/2" or larger shall be grooved full flow, welded or flanged. Fittings in lines 2" or smaller may, at the Contractor's option and with the written approval of the Architect/Engineer, be welded.
H. All branch Connections shall be made with standard "tee" or "wye" fittings.

2.03 JOINTS

A. Threaded and coupled piping systems shall be joined with properly lubricated screwed joints. Pipe shall be cut smooth and square and burrs shall be removed with a reamer. Tapered threads shall be properly cut on the male end of the pipe and shall be of a sufficient number so that when the pipe is pulled up tight in the coupling, at least three full threads remain exposed. Joints shall be made tight with graphite and oil or by means of a pipe joint compound such as Grinnel No. 1698 or 1699, applied to the pipe threads only and not to the
fittings. No pipe thread caulking compound shall be used. On galvanized piping systems after the piping has been fully assembled and tested all exposed threads shall be painted with a heavy coat of red lead or other rust inhibitive paint. Teflon tape may be used in lieu of the above specified pipe joint compounds at the Contractor's option.

B. Welded joints shall be made in accordance with the latest acceptable practices, codes and recommendations of the American Welding Society and the ASME.

C. Brazed joints shall be made using a filler material conforming to AWS A5.8-81, for refrigerant lines and 95-5 hard solder for other lines. All solder joints shall be made using the recommended flux for the solder selected. Solder joints in lines 2-1/2" or larger shall have both male and female members properly tinned before joining.

D. All joints between copper and ferrous materials shall be made up using an approved isolating connection equal to those produced by Epco Company of Cleveland, Ohio, or Victaulic Dielectric Waterway to prevent electrolysis.

E. Groove joints for steel pipe shall be "Victaulic, Tyco-Grinnell", Gruvlok or approved equal.
   a. Couplings shall be Victaulic Styles 107N/W07 or engineered approved equal. Gaskets shall be grade “EHP” EDPM designed for operating temperatures from -30 deg F to +250 deg F.
   b. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Three flexible couplings may be used in lieu of flexible connectors at equipment connections and shall be placed in close proximity to the vibration source. Victaulic Style 177, W77. Equipment may be dressed with Style 380, 381 and 382 assemblies along with Vic Header.
   c. Victaulic 300-Series/WVic-300 Butterfly Valve and 716/W716 Check Valve may be used with grooved piping system. Utilization of “Tri-Service” Assembly is acceptable
   d. Victaulic Style 730/W730 Strainers are acceptable. Contractor may utilize Victaulic Style 731D Suction Diffuser with grooved end piping system.

2.04 FLANGES, GASKETS & UNIONS

A. Welding flanges shall be forged steel, welding neck, raised face and bolt holes spot faced on back; of proper weight and design to match corresponding valve or fitting. Bolting shall conform to ANSI B16.5. As an option, contractor may use convoluted, cold-formed steel flanges conforming to Section VIII of ASME Code for Unfired Pressure Vessels in lieu of standard forged steel flanges, ANSI B16.5. Convoluted flange material shall conform to and meet ASTM A516.

B. Threaded flanges shall, unless otherwise noted, be 125-pound design cast iron with raised face bolt holes spot faced, galvanized or black to match adjoining pipe.

C. Copper flanges shall be cast copper, ASTM standard, for solder connection.

D. Groove type Victaulic flanges for steel pipe shall be 125/150-pound malleable iron with flat face and pressure responsive synthetic rubber gasket, galvanized or black to match adjoining pipe, style 741 or approved equal by Tyco-Grinnell.
E. Unions shall be 150-pound malleable iron, female pattern, brass to iron seat, ground joint, black or galvanized to match pipe being joined. Install unions adjacent to the downstream side of each threaded valve, on inlets and outlets of all specialties, apparatus and equipment having screwed connections to facilitate easy removal for repair or replacement, and elsewhere as shown on plans.

F. Gaskets for groove type couplings shall be "Victaulic" grade "E" (EPDM) or equal for chilled or hot water services with temperature limits of -30 degrees to 230 degrees F.

PART 3 - EXECUTION

3.01 All piping shall be installed as shown on the Drawings.

A. Hot water heating, electro-hydronic, condenser water, chilled water, steam, and air lines shall be pitched one inch (1") in forty feet (40') in direction of flow unless noted otherwise.

3.02 Piping shall be installed in true horizontal and vertical planes at right angles or parallel to building walls. Diagonal or bent piping will not be permitted.

3.03 Piping shall be installed tight to slabs, beams, joists, etc., where possible and such that any removable ceiling panels may be removed for access above ceilings.

3.04 Fittings shall be used for all changes in direction and all branch connections.

3.05 Do not use bullhead tees, street elbows, or bushings.

3.06 Any change in pipe size shall be made eccentrically in a manner to prevent air pockets in water lines or water pockets in steam, air or gas lines.

3.07 Provide drain valves at low points of piping systems and automatic air vents in high points. Install piping free of air or water traps, sags, and bends.

3.08 All piping shall be concealed above ceilings, in walls, in chases, in utility spaces or furred-in spaces wherever possible. Except in equipment rooms. Pipe serving equipment mounted against wall shall be concealed in wall behind unit and shall extend through the wall into back of the unit. No exposed risers from floor or ceiling to unit will be accepted.

3.09 Unions shall be furnished and installed adjacent to each valve, at the final connection to each piece of equipment or plumbing fixture, and where otherwise shown on the drawings and/or required.

3.10 Access shall be provided for operation, adjustment and maintenance as required. Where possible, install work-requiring access in an approved accessible location that will not require an access panel.

3.11 Unions shall be installed adjacent to each threaded valve and on inlets of all specialties, apparatus and equipment having screwed connections, to facilitate easy removal for repair or replacement, and elsewhere as shown on drawings. Unions may be omitted in grooved piping systems.

3.12 Flanges or grooves are required on valves, apparatus and equipment with 2-1/2" or larger connections.

3.13 All piping shall be installed so as to allow for normal expansion and contraction without damage to pipe, building or equipment. Expansion loops shall be provided as shown on the drawings and/or required.

3.14 Install piping connected to equipment so that pipe is not forced or sprung thereby exerting stress or strain on equipment. Contractor shall disconnect piping at equipment in order to demonstrate this at Engineer's request.
3.15 All pipe shall be carefully reamed. Threaded pipe shall have full length clean cut threads. Compression joints shall not be used.

3.16 Ends of all copper tubing and the interior of the cup of the fitting shall be thoroughly cleaned, de-burred, and prepared prior to the application of the flux and solder. The flux shall not be used as a substitute for proper joint preparation.

3.17 Where water piping passes over electrical gear or buss duct, furnish and install a galvanized sheet metal drip pan to catch any water that might leak onto electrical equipment. Pan shall have 2" sides with outlet drain piped to nearest floor drain.

3.18 Provide ample space between piping for insulation or jacket covering.

3.19 Increase pipe diameter one size wherever thermometer wells are installed in piping.

3.20 Pipe and fittings shall be stored on job site in such a manner to prevent dirt and foreign matter from getting into pipe. Before installation, pipe shall be cleaned on the inside so that a minimum amount of debris enters the piping system.

3.21 All lines passing through outside of building walls shall be caulked water tight to prevent leakage into the building.

3.22 Escutcheon plates shall be installed wherever exposed pipe passes through walls, or ceilings of finished portion of building. Caulk around pipes passing through floors.

3.23 Sleeves shall be installed during construction and provided for all pipe passing through floors, walls, slabs, or beams, to allow pipe movement. Do not mortar in any pipe to building construction.

3.24 Seal openings around pipes where penetrating walls, floors and partitions with material having a fire resistance rating equal to the fire resistance rating of the wall, floor or partition penetrated.

3.25 Install flexible connectors on each side of water pumps. Connectors need not be used for "in-line" circulators that are supported by the pipeline in which they are installed.

3.26 Drains from drip pans, overflows, relief valves, etc., shall be piped to nearest equipment or floor drain.

3.27 Insulating (dielectric) type unions shall be used whenever two dissimilar metals are being joined.

3.28 Tests and inspection shall be completed and approved by Engineer before covering or furring-in.

3.29 Valves shall be installed in all branch lines serving more than one piece of equipment, and elsewhere shown on plans or specified herein. Also each piece of equipment shall be valved separately with the same size valve as the line in which they are placed so that equipment can be removed without shutting off the entire main. Mount valve with stem in or above horizontal position.

3.30 Blow-off with 3/4" ball valve shall be installed in strainers one inch and larger. Install nipple and cap on valve discharge.

3.31 Drain fittings shall be provided at low point of pump volute, and elsewhere as required. Air vent required in volute and 1/4" flange taps for gauges. All air vents must be accessible.

END OF SECTION 230503
SECTION 23 05 29 - HANGERS & SUPPORTS

PART 1 - GENERAL

1.01 Approved hangers and stiff leg supports shall be installed in quantity and size as required to carry the weight of pipe, contents and insulation and shall be arranged to prevent vibration transmission to the building and allow for pipe movement.

1.02 Submit descriptive literature and shop drawings for approval.

PART 2 - PRODUCTS

2.01 Hangers shall be supported by means of uncoated solid steel rods, which are threaded to allow vertical adjustments. Lock nuts shall be provided in sufficient number and location to lock all rod adjustments permanently at the adjusted height. Two lock nuts shall be used unless the nut tightens against a threaded socket. Minimum rod diameters shall be as follows:

<table>
<thead>
<tr>
<th>Nominal Pipe Size</th>
<th>Rod Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot; through 2&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; and 3&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>4&quot; and 5&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>8&quot; through 11&quot;</td>
<td>7/8&quot;</td>
</tr>
<tr>
<td>12&quot;</td>
<td>1&quot;</td>
</tr>
</tbody>
</table>

2.02 Clevis hangers shall be like Grinnel Figure 260.

2.03 Roller hangers shall be like Elcen, Figure 14.

2.04 Roller chair shall be like Elcen, Figure 17.

2.05 Support of hangers shall be by means of beam clamps attached to structural steel.

2.06 All hanger supports shall be swivel type allowing for pipe movement.

2.07 All piping risers shall be securely supported at each floor level with clamp-on type support brackets and vibration isolators.

   A. Vertical Piping Supports shall be Elcen Figure 44, or approved equal, tempered steel offset clamps at each floor level.

   B. Spring cushion hangers shall be installed on top and bottom of each pipe riser rising more than two (2) floors.

2.08 Hangers for exposed copper pipe shall be copper plated steel. Hangers for pipe other than copper shall be painted as specified in painting section of these specifications.

2.09 Two piece galvanized steel thermal pipe shields shall be used for all insulated pipe installed on rollers or hangers.
2.10 Piping subject condensation such as cast iron storm piping (in horizontal runs), domestic cold water piping, etc., shall be supported by oversized hangers around the outside of the insulation, with pipe shields and pre-molded support blocking used to avoid crushing of insulation. A pre-manufactured Polypropylene “V” blocked, galvanized steel clevis hanger/saddle assembly by Anvil (#260 ISS) may be used in lieu of pipe shields and blocking.

2.11 Concrete or block supports shall be furnished and installed at the base of each soil, waste or storm water stack.

PART 3 - EXECUTION

3.01 Hanger spacing shall be in accordance with the following:

A. Cast iron soil pipe shall be supported at each joint, but in no case shall hangers be spaced over 5'-0" o.c.

B. Steel pipe shall be supported within 1'-0" of each change of direction, with a maximum spacing on straight runs in accordance with the following:

<table>
<thead>
<tr>
<th>Size</th>
<th>Maximum Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up through 3/4&quot;</td>
<td>7'-0&quot;</td>
</tr>
<tr>
<td>1&quot; through 2&quot;</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; through 4&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>6&quot; through 8&quot;</td>
<td>16'-0&quot;</td>
</tr>
<tr>
<td>10&quot; and larger</td>
<td>20'-0&quot;</td>
</tr>
</tbody>
</table>

C. Copper tubing shall be supported within 1'-0" of each change of direction, with a maximum spacing on straight runs in accordance with the following:

<table>
<thead>
<tr>
<th>Size</th>
<th>Maximum Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up through 1/2&quot;</td>
<td>6'-0&quot;</td>
</tr>
<tr>
<td>3/4&quot; through 1&quot;</td>
<td>8'-0&quot;</td>
</tr>
<tr>
<td>1-1/2&quot; through 2&quot;</td>
<td>10'-0&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; through 5&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>6&quot; and larger</td>
<td>14'-0&quot;</td>
</tr>
</tbody>
</table>

D. "No-Hub" cast iron shall be supported on each side of the joining sleeve.

E. Plastic pipe shall be supported at intervals not exceeding six feet (6') and not more than 18 inches from each joint.

END OF SECTION 230529
SECTION 23 05 93 - AIR SYSTEM ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 Contractor shall provide the services of an independent testing and balancing agency, approved by the Engineer, who specializes in the balancing and testing of heating, ventilating, and air conditioning systems, to balance adjust, and test air moving equipment and air distribution systems as herein specified. Accepted specialists are Bledsoe, F.E.S., National, Independent, Fulton, United Air Works, Johnson Controls, or Gibson.

1.02 All instruments used by this agency shall be accurately calibrated and maintained in good working order.

1.03 Balancing technician shall make two (2) return inspection trips to the project, one at near heating design conditions and one during air conditioning design conditions for the purpose of checking out the entire system, and make any additional adjustments required at this time.

1.04 Contractor shall include an extended warranty of 90 days, after completion of test and balance work, during which time the engineer at his discretion may request a recheck or resetting of any outlet, supply air fan, or exhaust listed in test report. The contractor shall provide technicians and original test equipment to assist the engineer in making any tests he may require during this period of time.

PART 2 - TESTING PROCEDURE

2.01 Air balancing and testing shall not begin until system has been completed and is in full working order. The Contractor shall put all heating, ventilating, and air conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing.

2.02 The air balance engineer shall perform the following tests and balance system in accordance with the following requirements.

2.03 Test and adjust supply, return and exhaust fans to design requirements.

2.04 Test and record electrical characteristics, R.P.M., service factor, measured voltage, full load amperes and corrected full load amperage. Check and record starter size, heater sizes and rating, replacement belt sizes, etc.

2.05 Make pilot tube traverse of main supply ducts and obtain design of CFM at fans. Seal all test holes with suitable hole plugs.

2.06 Test and record system static pressures, suction and discharge.

2.07 Test and adjust system for design recirculated air, CFM.

2.08 Adjust all main supply and return air ducts to proper design CFM.

2.09 Test and adjust each diffuser, grille, and register to within 10% of design requirements.

2.10 Each grille, diffuser, and register shall be identified as to location and area.

2.11 Size, type, flow factor and manufacturer of diffusers, grilles, registers and all tested equipment shall be identified and listed.

2.12 Readings and tests of diffusers, grilles and registers shall include required RPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
2.13 All diffusers, grilles, and registers shall be adjusted to minimize drafts in all areas.

2.14 Check water temperatures at inlet and outlet side of coils. Note rise or drop of temperatures from source.

2.15 Upon completion of flow readings and adjustments, mark all valve settings.

2.16 Upon completion of the balancing, compile the test data and submit three (3) copies of the complete test data as follows:

2.17 Type all test data on 8½" x 11" test forms, (forms to be as approved by A/E) with accompanying schematic diagrams of air distributions system. All test reports to be assembled, indexed, and submitted in vinyl covered loose-leaf notebooks with project name and balancing contractor's name permanently printed thereon. Forward copies for evaluation and approval of Engineer and Owner.

2.18 Submit for approval the following test data.

**FAN SYSTEMS**

A. Record CFM of main supply ducts.
B. Record CFM of main return ducts.
C. Record CFM of main fresh air ducts min. position.
D. Record CFM of all exhaust systems.
E. Record CFM of all grilles, registers and diffusers.

**FANS & AIR HANDLING UNITS**

F. Record total static pressure.
G. Record fan RPM (use revolution counter).
H. Record fan motor operating voltage and amperes.
I. Record fan motor nameplate data.
J. Record fan nameplate data.
K. Record CFM by making pilot tube traverse of main duct.

**COILS, HEATING & COOLING**

L. Record total CFM across coil.
M. Record entering and leaving air temperature (W.B. and D.B. heating and cooling).
N. Record water flow.

**END OF SECTION 230593**
SECTION 230700 - PIPE INSULATION

PART 1 - GENERAL

1.01 Pipe insulation shall be installed as shown on drawings and specified herein.

1.02 Insulation thickness and type shall be as specified in paragraph 3.03 hereinafter. The type is described in Part 2.

PART 2 - PRODUCTS

2.01 Acceptable manufacturers are Owens Corning, Knauf, CertainTeed, Johns-Manville and Armstrong.

A. Rigid glass fiber pipe insulation shall be factory molded rigid type, .25 maximum K factor at 100°F. differential, and heavy density.

B. Vapor barrier jacket shall be Underwriters Laboratory rated noncombustible, flame retardant, fire resistant, vinyl coated and embossed vapor barrier laminate; like fiberglass ASJ.

C. Foam glass insulation shall be closed cell construction cellular glass, factory molded, 100 psi compressive strength, minimum density 9 pounds per cubic foot, maximum K factor of .55 at 300°F. differential.

D. Foam plastic insulation shall be flexible closed cell construction, ozone resistant, minimum density 5 pounds per cubic foot, maximum K factor .26 at 75°F. differential, maximum water vapor transmission of .1 perm per inch, and physically and chemically stable from -40° to 220°F.; like Armacell, "Armaflex".

E. Polyurethane insulation shall be rigid closed cell construction, maximum K factor .16 at 75°F. differential, maximum water vapor transmission of .02 perm per inch, nominal density 2.0 pounds per cubic foot. Install with factory applied vapor jacket; like Owens Corning, Armstrong Armalok, with ASJ Jacket.

F. Phenolic foam insulation shall be rigid closed cell construction, .23 K factor at 75°F. differential, 2 lb. density, vapor transmission .02 perm per inch, like Armstrong Accootherm can be used whenever glass fiber is specified.

G. Sealants and adhesives shall be of composition and application as recommended by the insulation manufacturer.

H. All insulations shall be UL listed and shall have composite UL flame spread and smoke developed ratings not exceeding 25 and 50, respectively, as tested by ASTM E 84, NFPA 255 and UL 723 procedures. Accessories such as adhesives, mastics, cements, tapes, glass fabric, asbestos cloth, etc., shall have the same component ratings as the insulation.

PART 3 - INSTALLATION

3.01 GENERAL

A. Installation shall be made in accordance with manufacturers recommended procedure in a neat and workmanlike manner to the approval of the Architect / Engineer.

B. Furnish and use all mastics, adhesive and sealers as recommended by the manufacturer of the type of insulation installed.
C. All vapor jackets shall have butt and longitudinal joints overlapped (minimum 2" overlap) and sealed with adhesive.

D. Vapor barrier jackets shall be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces shall be adequately insulated and vapor-sealed to prevent condensation.

E. Miter end joints of pipe insulation at 45° where insulation butts against pumps, fittings or equipment. Seal end of mitered insulation with recommended insulation sealer.

F. Insulation installed on work located in spaces subject to ambient temperatures below freezing shall be covered with twice the thickness of insulation specified for normal spaces.

G. Insulation installed exposed outside of building shall be twice the thickness specified for within the building and shall also have .016" thick aluminum protective jacket held in place with aluminum bands on maximum 18" centers, or with screws.

H. Insulation contractor shall replace with new and perfect work all insulation which is deformed, cracked, separated joints, sagging, dented, damaged, loose covering or tape, or otherwise presenting an unworkmanlike appearance at the time of final inspection.

3.02 PIPE APPLICATION

A. Factory molded glass fiber insulation shall be installed using minimum 4" wide adhesive strips on maximum 12" centers. All joints shall be sealed using waterproof sealer.

B. All valves, fittings, etc. in piping installations shall be insulated with mitered sections or factory made preformed fitting of the same material as that covering the pipe. Removable portions of valves, strainers, etc., shall be insulated in such manner that the removable parts can be serviced without disturbing the insulated body. Fittings covered with factory molded glass fiber insulation shall have additional PVC applied with adhesive and overlapping the adjacent pipe covering.

C. All end joints on pipe insulation shall have a 45° miter.

D. Piping within walls and piping within pipe chases and utility spaces shall be covered. All insulation shall be continuous through wall and ceiling openings and sleeves.

E. Insulation shall not be applied until lines are tested as specified with results approved by the Engineer.

F. Seal off pipe insulation of vertical pipe support at both sides of clamp with recommended sealer. Insulate clamp to proper thickness to prevent condensation and seal insulation.

3.03 INSULATION REQUIREMENTS

A. Insulate all new condensate drainage piping with ½” wall closed cell elastomeric.

B. Insulate refrigerant suction piping with ½” wall closed cell elastomeric. Exterior piping to receive two coats Armaflex WB Finish system, white.

END OF SECTION 230700
SECTION 23 07 10 - DUCTWORK INSULATION

PART 1 - GENERAL

1.01 Thermal insulation shall be installed as shown on drawings and specified herein.

1.02 Ducts indicated on drawings are to be lined with a minimum of 1" thick insulation and will not require external insulation.

1.03 Duct sizes shown on drawings are inside dimensions of duct liner on internally insulated ducts.

PART 2 - PRODUCTS

2.01 Acceptable manufacturers are Owens-Corning, CertainTeed, Johns-Manville, and Armstrong.

2.02 Rigid board glass fiber duct insulation shall be .22 maximum K factor at 75 degrees F mean temp., minimum density 6 pounds per cubic foot, with integral non-asphalitic fire resistant, laminated vapor barrier jacket of .001 inch thick aluminum reinforced foil facing-glass fiber scrim, flame proof laminate, Underwriters approved.

2.03 Blanket glass fiber insulation shall be long fiberglass blanket type, .26 B. maximum K factor at 75 degrees F mean temp, minimum density 3/4 pound per cubic foot, with vapor barrier jacket specified herein, extending 2 inches beyond glass fiber for lap joint sealing.

2.04 Duct liner for ducts shall be minimum 1" thick, 1-1/2" pound density per cubic foot, having mat faced or monolithic construction with skin smooth surface to withstand velocities to 4,000 fpm. Sound insulation shall fit snugly against the interior duct surfaces, and be fastened to the duct with a 50% heavy coat of recommended adhesive and metal fasteners, which do not pierce the duct, spaced on 12-inch centers. All exposed edges of the insulation shall be coated with manufacturer's recommended adhesive.

2.05 Foam plastic insulation shall be flexible closed cell construction, ozone resistant, minimum density 5 pounds per cubic foot, maximum K factor .26 at 75 degrees F differential, maximum water vapor transmission of .1 perm per inch, and physically and chemically stable from -40 degrees to 220 degrees F.; like Armstrong "Armaflex". "Standard" Armaflex sheet insulation may be applied in thicknesses of 1/2" and less without exceeding the smoke developed rating of 50.

2.06 Polyurethane insulation shall be rigid closed cell construction, maximum K factor .16 at 75 degrees differential, maximum water vapor transmission of .02 perm per inch, nominal density 2.0 pounds per cubic foot. Install with factory applied vapor jacket; like Owens Corning Type 250.

2.07 Sealants and adhesives shall be of composition and application as recommended by the insulation manufacturer.

2.08 All insulations shall be UL listed and shall have composite UL flame spread and smoke developed ratings not exceeding 25 and 50, respectively, as tested by ASTM E 84, NFPA 255 and UL 723 procedures. Accessories such as adhesives, mastics, cements, tapes, glass fabric, asbestos cloth, etc., shall have the component ratings as the insulation.
PART 3 - EXECUTION

3.01 Insulate exposed and concealed round air ducts and plenums with 3/4-pound density, 1-1/2” or 3” thick flexible glass blanket insulation with vapor jacket. Fasten insulation to the ducts with 4” wide strips of waterproof adhesive on 12” centers, and seal all joints both circumferential and horizontal with manufacturer recommended vapor barrier adhesive.

3.02 Round flexible air ducts shall be factory insulated.

3.03 Installation shall be made in accordance with manufacturer's recommended procedure in a neat and workmanlike manner to the approval of the Engineer.

3.04 Furnish and use all mastics, adhesives and sealers as recommended by the manufacturer of the type of insulation installed.

3.05 All vapor jackets shall have butt and longitudinal joints overlapped (minimum 2” overlap) and sealed with adhesive.

3.06 Vapor barrier jackets shall be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces shall be adequately insulated and vapor-sealed to prevent condensation.

3.07 Miter end joints of pipe insulation at 45 degrees where insulation butts against pumps, fittings or equipment. Seal end of mitered insulation with recommended insulation sealer.

3.08 Insulation installed on work located in spaces subject to ambient temperatures below freezing shall be covered with twice the thickness of insulation specified for normal spaces.

3.09 Insulation installed exposed outside of building shall be twice the thickness specified for within the building and shall also have .016” thick aluminum protective jacket held in place with aluminum bands on maximum 18” centers.

3.10 Insulation contractor shall replace with new and perfect work all insulation, which is deformed, cracked, separated joints, sagging, dented, damaged, loose covering or tape, or otherwise presents an unworkmanlike appearance at the time of final inspection.

PART 4 - WORK TO BE INSULATED

4.01 Insulate all round and rectangular supply ductwork from furnaces and rooftop units within conditioned plenums, with 1½” thick fiberglass wrap.

END OF SECTION 230710
**PART 1 - GENERAL**

1.01 The Mechanical Contractor shall be responsible for the furnishing and installation of sheet metal ducts in connection with the heating, ventilating and air conditioning systems.

1.02 Unless otherwise noted, all ducts shall be galvanized iron, fabricated and installed in accordance with the latest issue of SMACNA HVAC Duct Construction Manual and/or the chapter on "Air Duct Design" in the most recent ASHRAE Guide and Data Book.

**PART 2 - PRODUCTS**

2.01 Acceptable manufacturers of low-pressure sheet metal accessories, Monroe Metal Products, United, LindLab, Eastern Sheet Metal, LaPine, and NCA.

2.02 Galvanized sheet metal duct work material and construction:

2.03 Materials shall be galvanized #1 smooth finish cold rolled open-hearth steel which will double seam without fracture. Cooling tower discharge ductwork shall have a galvanized thickness of 2.10.

2.04 Joints - Transverse - Standing Seam
   Longitudinal - Pittsburgh Locked Seam
   Corner - Pittsburgh Locked Seam

2.05 Bracing shall be angle iron stiffeners riveted to ducts where required to prevent vibration, sagging or buckling. Cross break all ducts over 12 inches wide for stiffness.

2.06 Turning vanes shall be installed in each supply duct offset and elsewhere as indicated on the drawings or as required to provide satisfactory non-turbulent airflow. Vanes shall be double formed tubular type like Titus or Tuttle & Bailey "Ducturns", or approved equal, installed in strict accordance with manufacturer's instructions.

2.07 At branch take-offs from main install splitter dampers, air extractors or manual dampers for adjustment of airflow.

2.08 Splitters shall be made of galvanized iron at least as thick as the duct where used. They shall be securely hinged at the air leaving edge, and made of two thicknesses so the entering edge presents a round nose to airflow. Length of splitter shall be at least 1-1/2 times the width of the smaller branch duct served. Splitters shall have 3/8" steel rod hinged to air entering edge and passing through a suitable clamp on side of duct to permit position adjustment and provide a rigid anchor in final position. Splitters over 24" high shall have two anchor rods.

2.09 Extractors shall be a series of radius vanes attached to a pivoting frame and bracket. Provide a locking adjustment device operable from outside the duct. Like Tuttle and Bailey VLR.

2.10 Manual balance dampers located in branch ducts ahead of diffusers, grilles, and registers shall be installed where indicated on the drawings or as required to provide proper air distribution. Dampers shall be opposed multi-blade type with manual locking type quadrant - Titus AG-35-B, Nailor Industries, Greenheck, or Tuttle and Bailey #7S.

2.11 Fire/smoke dampers shall be provided and installed at corridor penetrations and where required.
2.12 Dampers shall be solid steel curtain type corrosion resistant galvanized steel construction, blades to rotate full 180° and stack compactly for minimum air resistance. Frame shall be continuous one-piece roll formed construction, 4” deep duct channel with mounting flanges. In closed position blades shall interlock completely for positive eliminating of flame/smoke passage. Dampers to provide 100% free area.

2.13 Fire/smoke dampers shall be a factory made product by a firm regularly engaged in the manufacture of this type equipment. They shall have been tested for 250 consecutive cycles of operation, corrosion resistance and for proper operation in a dust-laden atmosphere.

2.14 An adequately sized access door shall be provided by the sheet metal contractor at each damper for servicing.

2.15 Fire/smoke dampers shall be as manufactured by: Air Balance, Air Stream, Ruskin, American Warming, Prefco, Safeair, Nailor Industries, and Greenheck.

2.16 Flexible connections shall be provided between all fan openings and sheet metal work. Connection shall be vent glass, heavy glass fabric, double neoprene coated. Connections exposed to out-of-doors shall have rubber finish on outside surface. Connections shall be the first connection to the unit where possible. Material shall be U.L. rated.

2.17 Back draft dampers shall be aluminum multi-leaf type with felt edging on leaves and angle iron frames, balanced on brass bearings to open with .05” of water pressure, complete with adjustable counterbalance. Install backdraft damper for each exhaust fan.

2.18 Flexible duct shall be factory pre-insulated duct composed of a corrosion-resistant reinforcing wire helix permanently bonded and enclosed in polyester film, then covered with 1”, 3/4 lb. density fiberglass insulation blanket sheathed in a vapor barrier of flame-resistant vinyl. The duct must comply with the latest NFPA Bulletin 90A and be listed as Class 1 Air Duct Material, UL Standard 181. It shall be Type WG as manufactured by The WireMold Company, or approved equal.

2.19 Balancing dampers located in main low-pressure ductwork downstream from unit shall be of the opposed blade arrangement similar to American Warming Model No. DAA-P-50 and DAA-P-8150, AFFCO Type F-18 or equal. Frame size 2” x 1/2” x 1/8” channel; Blade 16 ga. on 1/2” diameter shaft; Bearings shall be bronze or Teflon bushing type, pressed into frame; Linkage 1/4” rod interconnecting blades, adjustment operable from extended shaft through frame of damper with quadrant locking device. Dampers larger than 6 square feet of face area shall be provided with two extended damper shafts and locking quadrants. Damper shall have a painted aluminum finish.

2.20 All ducts so noted on drawings or in insulation specification shall be internally lined. Liner shall be glass fiber, 1” thick 1-1/2 pound density.

2.21 Refer to Insulation Section for material specification and installation requirements.
2.22 Sealing Ductwork. All ductwork seams and joints shall be sealed with "E.C.-900" or "Hardcast" to form a complete airtight system.

2.23 Access doors shall be double thickness with 1" thick insulation between metal sides with frame; latches shall be sash locks. Provide neoprene gasket around door for air tightness.

**PART 3 - EXECUTION**

3.01 Flexible duct used at supply diffuser connections shall not exceed five feet in length.

3.02 Adhere to Drawings as closely as possible. The right is reserved, however, to vary run and shape of ducts and make offsets during progress of work, if required to meet structural or other interferences. Architect / Engineer shall be notified in advance of such changes.

3.03 Install ductwork in adherence to drawings and/or ceiling height schedules indicated on General Construction Drawings; consult with other trades and in conjunction with them, establish necessary space requirements for each trade, so as to maintain required headroom.

3.04 Openings through existing walls and floors required for ductwork will be provided under this contract. Sheet Metal Contractor shall prepare shop drawings locating new duct openings, and obtain approval in ample time to meet building construction schedule.

3.05 Ducts passing through walls that extend to slab above shall be encased in telescoping 20 gauge sheet metal sleeve that shall be furnished by the Sheet Metal Contractor to the masonry contractor to be installed in the wall while the wall is being built.

3.06 Duct risers shall be rigidly supported where they pass through floors, ceilings, walls or roof by angle iron frames spanning the opening, firmly attached to the building structure.

3.07 All ducts shall be suspended from structural members of the building framing system.

3.08 All angles and structural iron used on ductwork shall be steel and painted with one coat of rust inhibitor metal primer and one coat of general-purpose aluminum.

3.09 All ducts shall be of cross-break fabrication and installed in a neat manner to form a stiff rigid construction, free from sag or distortion between hangers and air tight throughout the system.

3.10 All round duct elbows shall be of the long radius type; throat radius shall equal the width of the duct.

3.11 All square or rectangular duct elbows shall be of the long radius type; throat radius shall equal the width of the duct or of the square throat type provided with double turning vanes.

3.12 Transitions in ductwork sizes shall be made with slopes of 1" in 7", or as approved by Architect / Engineer.

3.13 Access Doors. Provide access doors of sizes, which will afford easy access to all filters, all fan bearings, all dampers, all turning vanes, other equipment and devices requiring inspection and service.
3.14 Volume dampers shall be installed where shown on drawings and as required for proper air distribution.

3.15 Dissimilar metals shall be kept from direct contact with each other by the application of a coat of zinc primer to each surface and allowing it to dry before metals are fastened.

3.16 Curbs for power ventilators shall be furnished and installed complete by the Mechanical Contractor. Seal and counter flash as required for a leak-proof installation.

3.17 Sheet metal plenums shall be constructed in accordance with latest SMACNA Guide properly braced to prevent rumble with smooth inside surface to receive sound insulation.

3.18 Where ducts pass through openings in floors and walls, the space between the building construction and the duct shall be caulked with Thyokol, or equal, and sheet metal closures shall be provided so as to effectively close openings acoustically, around all portions of all ducts.

3.19 The Sheet Metal Contractor shall be responsible to furnish all adjustable sheaves for equipment furnished by him to obtain the required air balance determined by the balancing contractor.

3.20 The Sheet Metal Contractor shall start all fans initially, lubricate, and check rotation and balance to eliminate noise and vibration.

3.21 The Sheet Metal Contractor shall receive from the temperature control contractor and install all automatic control dampers required for the complete installation.

3.22 Contractor shall prepare shop drawings for all new sheet metal work. Drawings shall indicate new and existing structural members, proposed ceiling heights and in applicable areas, recessed light fixtures. Field verify conditions prior to fabrication. Submit shop drawings to other trades and verify proper coordination.

END OF SECTION 233113
SECTION 233130 - DUCT LINER

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Duct Lining.

1.02 REFERENCES
A. ASTM C553 - Mineral Fiber Blanket and Felt Insulation.
C. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
D. UL 723 - Test for Surface Burning Characteristics of Building Materials.
E. SMACNA - HVAC Duct Construction Standards.
F. SMACNA - Duct Liner Application Standard.

1.03 DEFINITION
A. Duct Sizes:
   1. Duct dimensions shown on the drawings are inside dimensions.
   2. Increase sheet metal size to allow for liner.

1.04 SUBMITTALS
A. Submit shop drawings and product data under provisions of Section 019020.

PART 2 - PRODUCTS

2.01 DUCT LINER - ACCEPTABLE MANUFACTURERS
A. Knauf Fiberglass
B. Owens-Corning Fiberglass Corp.
C. Manville Products Corp.
D. CertainTeed Corp.
E. Substitutions: Under provisions of Section 019020.

2.02 DUCT LINER
A. Flexible glass fiber duct liner composed of long, flame attenuated glass fibers bonded with a thermosetting resin; ASTM C553; UL 723; ASTM 1071.
   1. Air stream surface covered with a black fiberglass mat.

2.03 ADHESIVE - ACCEPTABLE MANUFACTURERS
A. 3M.
B. Foster.
2.04 ADHESIVE
   A. Insulation adhesive in accordance with NFPA Standard 90A requirements; No. 33
      manufactured by 3M.

2.05 MECHANICAL FASTENERS
   A. Fastening devices in accordance with SMACNA - HVAC Duct Construction Standards.
   B. Gripnail system of fastening accepted when installed in accordance with manufacturer's
      recommendations by review of the Architect / Engineer.

PART 3 - EXECUTION

3.01 DUCT LINER
   A. Install in accordance with latest edition of SMACNA - duct liner application standard.
   B. Install liner with treated surface exposed on air stream side of duct by means of adhesive and
      weld pins.
   C. Firmly butt liner at transverse joints and coat with adhesive.
   D. Completely cover all internal duct areas with duct liner.
   E. Overlap and compress longitudinal corner joints.
   F. Provide metal nosings over liner edge.
      1. Facing airstream at fan discharge.
      2. At intervals of lined duct preceded by unlined duct.
      3. At upstream edge of transverse joints for velocities over 4000 FPM.
   G. Repair rips and tears on the air stream surface by coating damage area with an approved duct
      liner adhesive.

3.02 ADHESIVE
   A. Spray or brush adhesive with 100% coverage over surface of duct prior to application of
      insulation.
   B. Coat liner edges facing airstream and not receiving sheet metal nosing thoroughly with
      adhesive.

3.03 FASTENERS
   A. Weld pins to sheet metal duct.
      1. Minimum of one pin per square foot insulation area.
      2. One pin per lineal foot on duct sides less than 12" wide.

END OF SECTION 233130
SECTION 233440 - CEILING EXHAUST FAN

PART 1 - GENERAL

1.01 Exhaust Fans (EF-X): Furnish and install all exhaust fans as indicated on the drawings of the various types, electrical characteristics and capacities indicated.

PART 2 - PRODUCTS

2.01 Acceptable Units are Greenheck, ACME, Twin City Fans, Penn, Barry or Jenn-Air.

2.02 Ceiling Exhaust Fan shall be similar to Greenheck Model SP with galvanized steel housing, adjustable mounting brackets, outlet duct and damper may be converted to horizontal or vertical discharge, grille shall be aluminum with baked enamel finish, color off-white. Wall or roof cap discharge accessories shall be furnished as required by application. See drawings for quantity and size.

2.03 Fan Motor shall be selected to properly accelerate and operate the fans without abnormal or prolonged starting current inrush. Motors shall be ball-bearing drip proof fan cooled, constant speed.

2.04 Fan Motor Starter for exhaust fans are to be automatically controlled and shall be magnetic type with overload and undervoltage protection, H.O.A. switch in cover.

PART 3 - EXECUTION

3.01 Exhaust Fans shall be located as shown on drawings, supported from building structure and installed in conformance with manufacturer’s instructions.

END OF SECTION 233440
SECTION 233460 - INTAKE AND EXHAUST HOODS

PART 1 - GENERAL

1.01 Furnish and install intake and exhaust hoods where shown on the drawings and as specified herein.

PART 2 - PRODUCTS

2.01 Furnish and install, where shown on the plans, aluminum hoods by Penn Ventilator Co., Greenheck, Jenn-Air, Carnes, Acme, or Louvers and Dampers.

2.02 Hood shall be all aluminum housing of low contour design, with large outlet area and bird screen.

2.03 Manufacturer's catalog ratings shall be based upon tests conducted in an industry approved testing laboratory with air volumes and losses as shown on the plans.

2.04 The following accessories shall be included: Twelve-inch (12") high factory-built curbs, birdscreen, and all weather shields.

PART 3 - EXECUTION

3.01 Anchor roof curbs and hoods securely in place.

END OF SECTION 233460
SECTION 23 37 13- AIR DEVICES

PART 1 - GENERAL

1.01 The Sheet Metal Contractor shall provide all air devices, materials operations or methods listed, mentioned or scheduled on the drawings for a complete ventilation system.

1.02 The drawing indicates the extent and general arrangement of the system. If any departures are deemed necessary or practical, they shall be submitted to the Architect for approval before any change or installation is made.

1.03 A complete schedule of all air devices shall be submitted for approval before placing order. Such schedule to include drawings showing construction, all physical dimensions and methods of connecting them to ductwork.

PART 2 - PRODUCTS

2.01 Acceptable units are Titus, Carnes, Anemostat, E.H. Price, Tuttle & Bailey, Nailor and Krueger.

2.02 Square ceiling diffusers shall be (like TITUS-TMS), 24” x 24” square pattern, fabricated of steel, rust-proofed after assembly and before specified finish is applied. Diffuser shall have extended pan frame to fit within an exposed tee-ceiling grid, or shall be furnished with a plaster frame when installed in a gypsum board ceiling.

2.03 Diffusers shall be finished with baked enamel, color off-white.

2.04 Diffuser Size 8” round neck to 320 CFM, 10” round neck 321 to 440 CFM, 12” round neck 441 to 575 CFM, 14” round neck 576 to 750, 15” round neck 751 to 1200 CFM.

2.05 Ceiling return air grilles (RG) shall be (like TITUS model number 50-MCH). Aluminum egg crate, square pattern design 1/2” x 1/2” x 1/2” grid. Finish clear lacquer over aluminum satin finish. Grilles shall be made for "T" bar ceiling installation or shall be furnished with a plaster frame when installed in a gypsum board ceiling.

2.06 Ceiling exhaust grilles (EG) shall be (like TITUS model number 50-MFR). Aluminum egg crate square pattern design 1/2” x 1/2” x 1/2” grid. Finish clear lacquer over aluminum satin finish, grilles shall have 1" wide frame less screw holes, and fitted with an opposed blade volume damper.

2.07 Supply air registers (SR or SG) shall be (like TITUS model #272-FS5) aluminum supply registers, face louvers set parallel to the short dimension and individually adjustable to any degree of horizontal deflection, rear louvers parallel to the long dimension and individually adjustable to any degree of vertical deflection. Opposed blade volume damper attached. Mounted in model #115 aluminum frame. Finish shall be baked enamel. Color off-white.

2.08 Sidewall Return/Transfer Register (RR): Shall be Titus Model 350ZFL Aluminum Return Grille. Face bars set parallel to long dimension and fixed in a 0-degree angle position. Finish shall be off white baked enamel. Provide with opposed blade volume damper.
2.09 **LINEAR SLOT PLENUM DIFFUSERS:** Linear Slot Diffusers shall be Titus model ML diffusers with MP plenum, two-element pattern controller in each slot, adjustable from face. 24 ga. galvanized steel. White T-bars with black pattern controller. ½” glass fiber plenum acoustical lining.

**PART 3 - EXECUTION**

3.01 Locations of diffusers shown on mechanical plans are approximate for estimating purposes only. Exact locations shall be determined on the job from architect's reflected ceiling plans when available or by coordination with other trade for balance, symmetry, and clearance.

**END OF SECTION 233713**
SECTION 23 63 13 - AIR COOLED CONDENSING UNIT

PART 1 - GENERAL

1.01 Furnish and install as shown on the drawings and as specified herein an air-cooled condensing unit.

1.02 The air-cooled condensing unit with remote evaporator shall be manufactured by Trane, Carrier, Daikin, Lennox, Aaon or York.

PART 2 - PRODUCTS

2.01 GENERAL UNIT DESCRIPTION

A. Provide factory assembled and tested outdoor air-cooled condensing unit, scroll compressors, condenser, refrigeration accessories, starter and control panel. Construction and ratings shall be in accordance with ANSI/ARI 590.

B. The unit shall have a capacity as indicated on the drawings.

C. Unit shall be designed for and fully charged with R-410A refrigerant.

2.02 COMPRESSORS

A. Construct scroll compressors with heat-treated forged steel and sealing surface immersed in oil. Rotors shall be of high-grade steel or cast iron alloy.

B. Statically and dynamically balance rotating parts.

C. Provide oil lubrication system with oil charging valve and oil filter to ensure adequate lubrication during starting, stopping, and normal operation.

2.03 CONDENSER AND FANS

A. Construct condenser coils of aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 500 psig.

B. Provide vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Entire fan assembly shall be statically and dynamically balanced and fan assembly shall be either painted or zinc coated steel. Fan guard shall be PVC, chrome or zinc coated.

C. Provide factory mounted, 4" square, heavy wire mesh, access guard that covers the service area beneath the condenser coils.

D. Provide fan motors with permanently lubricated ball bearings and built-in thermal overload protection.

E. Provide factory installed painted louvered coil guard panels for grade-mounted installations.
2.04 ENCLOSURES

A. House components in 12 gauge galvanized steel frame and mounted on welded structural steel base. Hot-dip galvanized steel frame coating shall be Underwriters Laboratories Inc. (UL) recognized as G90-U, UL guide number DTHW2.

B. Unit panels and control panels shall be finished with a baked on powder paint. Control panel doors shall have door stays. Paint system shall meet the requirements for outdoor equipment of Federal Government Agencies.

C. Factory mount wire starter and disconnect in weatherproof panel provided with full opening access doors. Provide lockable disconnect operating handle external to panel and clearly visible from outside of unit indicating if power is on or off.

2.05 REFRIGERANT CIRCUIT

A. Provide for each refrigerant circuit:
   1. Liquid line shutoff valve.
   2. Filter dryer (replaceable core type).
   3. Liquid line sight glass and moisture indicator.
   4. Electronic or thermal expansion valve sized for maximum operating pressure.
   5. Charging valve.
   6. Discharge and oil line check valves.
   7. Compressor suction and discharge service valves.
   8. High side pressure relief valve.

2.06 CONTROLS

A. On condensing unit, mount weatherproof control panel, containing starters, power and control wiring, and UL approved molded case disconnect switch with external lockable operator handle. Provide dual point power connection on unit at the factory mounted disconnect. Provide primary and secondary fused control power transformer.

B. For each compressor, provide across-the-line starter.

C. Provide the following safety controls with indicating lights or diagnostic readouts.
   1. High refrigerant pressure.
   2. Low oil flow protection.
   3. Contact for remote emergency shutdown.
   4. Loss of refrigerant charge protection.
   5. Motor current overload.
   6. Phase reversal/unbalance/single phasing.
   7. Over/under voltage.
   8. Compressor status (on or off).
D. Provide the following operating controls:
   1. Five minute solid state anti-recycle timer to prevent compressor from short cycling.
   2. Low ambient lockout control with adjustable setpoint.

PART 3 - EXECUTION

3.01 MANUFACTURER'S FIELD SERVICES

   A. Supply service of factory-trained representative to provide check, test, and start-up, and 1st year labor warranty.

   B. Manufacturer to provide a 5-year compressor replacement parts warranty.

   C. Installer shall supply initial charge of refrigerant and oil.

   D. Manufacturer to provide with his bid, the number of refrigeration circuits, recommended line sizing, and recommended jobsite routing.

END SECTION 236313
SECTION 23 74 14 – PACKAGED MAKEUP AIR UNITS

PART 1 - GENERAL

1.01 HVAC units shall be furnished and installed in areas shown on the drawings and herein specified.

1.02 Submit descriptive literature, wiring diagrams, shop drawings for approval.

PART 2 – PRODUCTS

2.01 Packaged Units

A. Units shall be draw-through arrangement with DX cooling coil, gas fired heat exchanger, outside air damper, filter, fan section, discharge plenum and mounting curb.

B. Each unit shall be completely factory assembled, piped, wired, tested and shipped in one piece with a single-point power connection. Outside air system, filters, switches, supply air fan system and all standard operating safety controls shall be furnished and factory installed. Units shall be specifically designed for outdoor application with a weatherproof cabinet. All units shall be shipped fully charged with Refrigerant. All units shall have decals and tags to indicate caution areas and aid unit service. Provide laminated labels to mark filter and lubrication panels. An electrical wiring diagram shall be attached to control panels. Installation and maintenance bulletins shall be supplied with each unit. Units shall be approved by U.L.

C. Cabinet Casing and Frame - Galvanized steel, phosphatized, and finished with pre-applied baked polyurethane enamel. Cabinet surface shall be tested 500 hours in salt spray in compliance with ASTM B117. Fully gasketed removable access panels. Structural members shall be heavy gauge with access doors and removable panels of heavy gauge. Provide 1/2 inch thick foil faced fiberglass insulation on all exterior panels and roof in contact with the return and conditioned air stream. Cabinet top cover shall be one piece construction or where seams exits, it shall be double hemmed and gasket sealed.

D. Refrigeration System

a. Evaporator Coil: DX 6 Row Interlaced: Internally finned, 5/16 inch copper tubes mechanically bonded to a configured aluminum plate fin shall be standard. Coils shall be leak tested at the factory to ensure the pressure integrity. The evaporator coil shall be leak tested to 500 psig and pressure tested to 500 psig. A Stainless Steel double-sloped condensate drain pan with provision for through the unit wall condensate drain is standard. Evaporator coil will have 6 interlaced rows for superior sensible and latent cooling.

b. Hot Gas Reheat: Modulating; Shall consist of a modulating hot-gas reheat coil located on the leaving air side of the evaporator coil prepiped and circuited with a low pressure switch. Refer to the Sequence of Operations section of the Installation, Operation and Maintenance manual for detailed unit control and operational modes.

c. Compressor: Scroll Compressor, Both Circuits; All units shall have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Internal overloads shall be provided with the scroll compressors. Crankcase heaters shall be included.
d. Condenser: Air Cooled; (Fin and Tube Coil) - Internally finned, 5/16 inch copper tubes mechanically bonded to a configured aluminum plate fin shall be standard. Coils shall be leak tested at the factory to ensure the pressure integrity. The condenser coil shall be leak tested to 500 psig and pressure tested to 500 psig. The condenser coil shall have a fin design with slight gaps for ease of cleaning. Provide perforated metal hail guards.

e. Capacity Control: APR Valve on 1st Circuit; Service pressure ports, and refrigerant line filter driers are factory-installed as standard. An area shall be provided for replacement suction line driers. Capacity is controlled by Adiabatic Proportional Regulator (APR) installed on the lead circuit.

E. Gas Heating Section - Primary heat is supplied using indirect fired gas heating. The heating section shall have a progressive tubular heat exchanger design using Stainless Steel burners and type 439 Stainless Steel tubes. An induced draft combustion blower shall be used to pull the combustion products through the firing tubes. The heater shall use a direct spark ignition (DS) system. On initial call for heat, the combustion blower shall purge the heat exchanger for 20 seconds before ignition. After three unsuccessful ignition attempts, the entire heating system shall be locked out until manually reset at the thermostat/zone sensor. Unit shall be suitable for use with Natural Gas.

F. Supply Fan Section - Supply fan shall be forward curved, double inlet centrifugal type. All units shall be belt driven by a permanently lubricated motor with inherent overload protection. The motor shall have a variable pitch sheave and adjustable base for proper alignment and belt tension adjustment.

G. Filters. Aluminum Mesh Filters shall be installed on the intake of the unit. In addition, one row of 2 inch MERV-8 rated filters (30 percent) shall be installed prior to the evaporator coil.

H. Provide one set for start-up and two (2) additional sets for Owner use.

I. Outside Air - Outside air arrangement shall be 100% outside air with automatic economizer control, with air intake hood and protective screen. The damper motor shall be of the spring return type to close the outside air damper when the unit is not operating.

J. Horizontal Discharge Curb – If required, provide a factory manufactured galvanized steel curb adapter custom sized to mate new unit to horizontal discharge ducts. Gasketing shall be provided to form a positive, weathertight seal between the curb, adaptor and unit.

K. Electrical - Each unit shall be wired and tested at the factory before shipment. Wiring shall comply with NEC requirements and shall conform to all applicable U.L. standards. All wiring shall be number coded per the electrical wiring diagrams. All electrical components shall be labeled according to the electrical diagram and be U.L. recognized where applicable. Each unit shall have a 24-volt control circuit transformer and control circuit fuse. Provide single point of electrical connection for all unit components including compressor, fans and controls.

L. Provide factory installed electronic controls with comparative enthalpy economizer.

M. Manufacturer shall be Trane, Daikin, Aaon, Carrier or York.

N. Unit shall be completely factory wired with necessary controls and contactor pressure lugs for power wiring. Units will provide an external location for mounting fused disconnect device. Micro-processor controls are provided for all 24 volt control functions. The resident control algorithms will make all heating, cooling and/or ventilating decisions in response to electronic signals from sensors measuring outdoor temperature and humidity as well as indoor temperature. The control algorithm maintains accurate temperature control and minimizes drift from set point.
A centralized micro-processor (OACM) will provide anti-short cycle timing for a higher level of machine protection.

O. Terminals shall be provided for a field installed dry contact or switch closure to put the unit in the Occupied (On) or Unoccupied (Off) modes.

P. Diagnostic Functions shall include: Unit operating mode, Unit failure status, cooling failure, emergency service stop indication, supply fan proving, timed override activation, high temperature thermostat status, Zone temperature, Supply air temperature, Cooling status (all stages), Stage activated or not, Stage locked out by UCP, HPC status for that stage, Compressor disable inputs, Number of stages activated, High temperature limit status, Economizer status, Enthalpy favorability status, Requested minimum position, Damper position, Dry bulb/enthalpy input status, Outside air temperature, Outside relative humidity, Sensor Failure: Humidity sensor, OAT sensor, SAT sensor, RAT sensor, Zone temperature sensor, Mode input, Static pressure transducer, Unit mounted potentiometer, SAT from potentiometer, Air reset setpoint from potentiometer, Unit Configuration data, Economizer present, High temp input status, Local setpoint, Local mode.

Q. Controller shall have full BACnet/IP two way communications capability.

PART 3 - EXECUTION

3.01 The Unit shall be positioned and leveled as required for a complete vibration free installation.

3.02 Each Unit shall be fitted with a trap at each drain outlet.

3.03 The manufacturer must send an installation expert to the jobsite to advise on proper rigging and alignment of the equipment. The installing contractor should become familiar with the manufacturer's rigging and installation instructions.

3.04 CHECK, TEST, STARTUP AND WARRANTY

Unit must be checked out, tested, and placed into operation by the installing contractor under the supervision of an authorized representative of the factory. Equipment shall have a standard 1-year parts warranty and the compressors and heat exchanger must include an additional 4-year parts warranty. The installing contractor must be responsible for warranty service and maintenance during the first year of equipment operation.

END OF SECTION 237414
SECTION 23 81 26 – SPLIT SYSTEMS

PART 1 - GENERAL

1.01 System Description
A. Outdoor air--cooled split system compressor sections suitable for on--the--ground, rooftop, wall hung or balcony mounting. Units shall consist of a scroll compressor, an air--cooled coil, propeller--type blow--through outdoor fan, reversing valve (HP), accumulator, metering device(s), and control box. Units shall discharge air horizontally with wall mount or ceiling cassette arrangement as shown on the contract drawings. Units shall function as the outdoor component of an air-to-air cooling only, or heat pump system.
B. Units shall be used in a refrigeration circuit matched to duct--free cooling only or heat pump fan coil units.

1.02 Agency Listings
A. Unit construction shall comply with ANSI/ASHRAE 15, latest revision, and with the NEC.
B. Units shall be evaluated in accordance with UL standard 1995.
C. Units shall be listed in the CEC directory.
D. Unit cabinet shall be capable of withstanding 500--hour salt spray test per Federal Test Standard No. 141 (method 6061).
E. Air-cooled condenser coils shall be leak tested at 573 psig.

1.03 Delivery, Storage, and Handling
A. Units shall be shipped in one piece and shall be stored and handled per unit manufacturer’s recommendations.

1.04 Warranty
A. 1-year parts, 5-year compressor limited warranty.

1.05 Manufacturer
A. LG, Trane, Daikin, Carrier, York, Mitsuishi

PART 2 - PRODUCTS

2.01 Equipment
A. General:
   1. Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and the compressor.
B. Unit Cabinet:
   1. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked enamel finish on inside and outside.
   2. Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components.
   3. Outdoor compartment shall be isolated and have an acoustic lining to assure quiet operation.
4. Compressor compartment shall be isolated to allow performing diagnostics while the system is running.

C. Fans:
   1. Outdoor fans shall be direct-drive propeller type, and shall discharge air horizontally. Fans shall blow air through the outdoor coil.
   2. Outdoor fan motors shall be totally-enclosed, single phase motors with class B insulation and permanently-lubricated bearings. Motor shall be protected by internal thermal overload protection.
   3. Shaft shall have inherent corrosion resistance.
   4. Fan blades shall be metallic and shall be statically and dynamically balanced.
   5. Outdoor fan openings shall be equipped with PVC coated metal protective grille over fan.

D. Compressor:
   1. Compressor shall be fully hermetic scroll type.
   2. Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from over-temperature and over-current.
   3. Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere.
   4. Compressor assembly shall be installed on rubber vibration isolators.
   5. Compressors shall be available in single-phase (sizes 018--036) and three-phase (size 036).

E. Outdoor Coil:
   1. Coil shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, which are cleaned, dehydrated, and sealed.

F. Refrigeration Components:
   1. Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, reversing valve.

G. Controls and Safeties:
   Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:
   1. Controls:
      a. A time delay control sequence is provided standard through the fan coil board.
      b. Automatic outdoor--fan motor protection.
   2. Safeties:
      a. Diagnostics provided by matched indoor unit.
      b. Compressor motor current and temperature overload protection.
      c. Outdoor fan failure protection (High Pressure Switch).
      d. Low pressure protection.
e. Fusible plug to vent refrigerant safely in case of a fire.

H. Electrical Requirements:
   1. All sizes shall operate on single--phase, 60 Hz power at 208/230V or on three--phase, 60 Hz power at either 208/230 or 460 (for 036 size units).
   2. Unit control voltage to the indoor--fan coil shall be 24 VDC.
   3. All power and control wiring must be installed per NEC and all local electrical codes.

I. Refrigerant Line Lengths:
   1. The unit shall be capable of 200 ft (61 m) maximum piping, a maximum lift (fan coil above) of 65 ft (19.8 m) and a maximum drop (fan coil below) of 150 ft (45.8 m).

J. Special Features (Field Installed):
   1. Low--Ambient Kit: Control shall regulate fan--motor cycles in response to saturated condensing temperature of the unit. The control shall be capable of maintaining a condensing temperature of 100 °F ± 10 °F with outdoor temperatures to -20 °F. Installation of kit shall not require changing the outdoor fan motor.
   2. Wall mounted, wired thermostat controller.

PART 3 - EXECUTION

3.01 Units shall be provided with a temporary 1" thick fiberglass air filter installed in a slide-in channel at the filter plenum. Piping and electrical connections shall be so located to eliminate any interference with removal and replacement of filter.

3.02 First Year, Unit Manufacturer shall warrant all parts to be free from defects in material and workmanship and contractor shall provide labor to correct deficiencies that occur.

3.03 Acceptance Run. After equipment is installed, each item shall be tested to show performance. After all tests are made, the entire system shall be placed in operation and run and operated trouble free for a period of 96 hours continuously before acceptance.

3.04 Replace Filters prior to building acceptance by Owner.

3.05 Check-Test-Start Procedure. Unit manufacturer shall provide factory trained service technician to supervise original start-up of the units for final operation. Contractor shall provide labor to accomplish check, test and start procedure as recommended by unit manufacturer. Owner's rep. shall be notified in advance of check-test-start and scheduled to be present.

3.06 At Time of Check-Test-Start, Contractor shall leak test, evacuate and charge units in accordance with instructions of manufacturer's technician. Contractor shall supply all refrigerant. Unit manufacturer's service technician shall check and calibrate all controls at this time to assure proper operation. Replace damaged or malfunctioning controls and equipment.

PART 4 - INSTALLATION

4.01 Install units where shown on drawings using required structural members and roof curbs to adequately support unit from building structure.
END OF SECTION 23 81 26
SECTION 23 82 18 – ELECTRIC CABINET UNIT HEATERS

PART 1 - GENERAL

1.01 Unit Heaters shall be furnished and installed in areas shown on the drawings and herein specified.
1.02 Submit descriptive literature, wiring diagrams, shop drawings for approval.

PART 2 - PRODUCTS

2.01 ELECTRIC UNIT HEATERS

A. All basic series units shall be ETL or UL listed.
B. Construction: The chassis construction shall be 16-gauge galvanized steel, and continuous throughout the unit. The cabinet exterior shall be finished with a textured powder coat epoxy.
C. Fan: The aluminum fan wheels shall be centrifugal forward-curved and double-width. Fan wheels and housings shall be corrosion resistant, formed sheet metal.
D. Motor: The motor shall be permanent split capacitor, integral thermal overload protection, and permanently lubricated. It shall be capable of starting at seventy-eight (78) percent of rated voltage and operating at ninety (90) percent of rated voltage on all speed settings. The motor shall be run tested in assembled units.
E. Heating Elements: The heating elements shall be warranted for 1 year and shall be non-glowing design consisting of high temperature resistance wire enclosed in an incoloy sheath to which steel fins are furnace brazed. The heating elements shall be located directly in front of the blower discharge air for uniform heating. They shall be mounted with a single anchor at one end to minimize effects of thermal expansion and contraction.
F. Safety Cutout: Thermal safety limits shall be built into the system to automatically shut off heater in event of overheating due to any cause. The safety cutouts shall be of two types:
   1. The primary limit shall be an automatic capillary type to sense the heat along the full length of the heating elements. It shall de-energize the heaters by opening the coil circuit on the heating contactors.
   2. The secondary limit shall be a manual reset thermal device to interrupt power to the heating elements
G. High and Low Heat Ranges: All units 277 volts and less shall be supplied as standard with a switch for selecting full heat at high fan speed or reduced heat at low fan speed.
H. Temperature Control: Where scheduled, Integral factory installed thermostat shall be tamper resistant, linear capillary type. Where temperature control interface is scheduled or required, provide 24 volt control transformer and relay.
I. Manufacturers: Markel, Chromalox, Indeeco, or Qmark.

PART 3 - EXECUTION

3.01 INSTALLATION OF UNITS

A. General: Install units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
B. Electrical Wiring: Install and connect electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's electrical connection diagram submittal to electrical contractor.

3.02 FIELD QUALITY CONTROL: Start up units in accordance with manufacturer's start up instructions. Test controls and demonstrate compliance with requirements.

END OF SECTION 238239
SECTION 260500 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

1.02 SUMMARY
A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:
   1. Submittals.
   2. Coordination drawings.
   3. Record documents.
   5. Rough-ins.
   6. Electrical installations.
   7. Cutting and patching.

B. Related Sections: The following sections contain requirements that relate to this section:
   1. Division 23 Section "ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT," for factory-installed motors, controllers, accessories, and connections.

1.03 SUBMITTALS
A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS."
B. Additional copies may be required by individual sections of these Specifications.

1.04 COORDINATION DRAWINGS
A. Prepare coordination drawings in accordance with Division 1 Section "PROJECT COORDINATION," to a scale of 1/8"=1'-0" or larger; detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
   1. Indicate the proposed locations of major raceway systems, equipment, and materials.
      Include the following:
      a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
      b. Exterior wall and foundation penetrations.
      c. Fire-rated wall and floor penetrations.
      d. Equipment connections and support details.
      e. Sizes and location of required concrete pads and bases.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Check reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communications systems components, and other ceiling-mounted devices.

5. Where a number of electrical panels and/or related electrical items are shown, the Electrical Contractor shall coordinate the physical sizes with his equipment suppliers to ensure that there is adequate space for the items shown to be installed in those areas. Provide electrical room layout showing switchboards, panels and wall mounted equipment locations with shop drawings.

6. The Contractor shall rearrange the equipment layout to achieve full use of the available space prior to installing conduit stubs ups. Where a conflict or rearrangement exists the contractor shall submit a proposed revised layout of the area to the Architect.

1.05 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, indicate installed conditions for:

1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.

2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.06 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instruction; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures and routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 26 for rough-in requirements.

3.02 ELECTRICAL INSTALLATIONS

A. General: Sequence, coordinate and integrate the various elements of electrical systems, materials and equipment. Comply with the following requirements:

1. Coordinate electrical systems, equipment, and materials installation with other building components.

2. Verify all dimensions by field measurements.

3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.

4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

6. Mounting heights to bottom of box and above finished floor for the below-named items shall be as follows, unless otherwise shown. All other devices mounting heights shall be as shown on the drawings.

   a. Flush tumbler switch - 48” to centerline.
   b. Convenience outlets - 18” to centerline, mounted vertically with ground prong slot at bottom.
   c. Safety switches - 54” to top.
   d. Motor controllers - 54” to top.
   e. Communications outlets - 18” to centerline.
   f. Receptacles above counters - 6” to centerline above counters or backsplash.
   g. Convenience outlets in mechanical, electrical janitor rooms - +48 to centerline.
   h. Exterior W.P. convenience - 24” above grade mounted - (vertically) with in-use cover.

7. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

8. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.

9. Coordinate connection of electrical systems with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
10. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.

11. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

12. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

13. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "ACCESS DOORS".

14. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

15. Provide permanent operational data nameplate on each item of power operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

3.03 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
   a. Uncover Work to provide for installation of ill-timed Work.
   b. Remove and replace defective Work.
   c. Remove and replace Work not conforming to requirements of the Contract Documents.
   d. Remove samples of installed Work as specified for testing.
   e. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.

2. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

3. Patch finished surfaces and building components using new materials specified for the original installation and experienced installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
   a. Refer to Division 1 Section "DEFINITIONS AND STANDARDS" for definition of experienced "Installer".

3.04 HAZARDOUS MATERIAL DISPOSAL

A. Fluorescent light ballasts and lamps shall be removed and disposed of separately from construction debris. Proper personal protective equipment must be used when handling leaking PCB ballasts.
B. Contractor shall provide appropriate steel drums. Contractor shall separate PCB ballasts from NON PCB ballasts and put in drums. Contractor will take responsibility for proper disposal of PCB containing material. Contractor shall dispose of NON PCB containing ballasts.

C. Wipe light fixture’s metal parts clean of deposits leaked from ballasts and dispose of rags with ballasts. Spills must be cleaned in accordance with the national PCB Spill Cleanup Policy (52 FR 10688).

D. Fluorescent lamps shall be considered hazardous waste containing mercury, lead, and cadmium. Contractor shall obtain company services and provide proper packaging and shipping of lamps to company. Disposal to meet all Federal and State requirements.

E. All waste shall be labeled, stored, handled, transported and disposed of in accordance with applicable State and Federal regulations.

END OF SECTION 260500
SECTION 260519 - WIRES AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Requirements of the following Division 26 Section apply to this Section:
   1. "Basic Electrical Requirements."

1.02 SUMMARY

A. This Section includes wires, cables, and connectors for power, lighting, signal, control and related systems rated 600 volts and less.

B. Related Section: The following Sections contain requirements that relate to this section:
   1. Division 31 Section "Earthwork" for trenching and backfilling for direct buried cable.
   2. Division 26 Section "Electrical Boxes and Fittings" for connectors for Terminating Cables in boxes and other electrical enclosures.

1.03 QUALITY ASSURANCE

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

B. NFPA 70 "National Electrical Code."
   1. Conform to applicable codes and regulations regarding toxicity of combustion products of insulating materials.

C. UL Compliance: Provide components that are listed and labeled by UL under the following standards:
   1. UL Std. 4 Armored Cable.
   2. UL Std. 83 Thermoplastic-Insulated Wires and Cables.
   3. UL Std. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors.

D. NEMA/ICEA Compliance: Provide components that comply with the following standards:
   1. WC-5 Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
   2. WC-7 Cross Linked Thermosetting Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

E. IEEE Compliance: Provide components that comply with the following standard.
   1. Std. 82 Test procedures for Impulse Voltage Tests on Insulated Conductors.
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Wire and Cable:
   a. Anaconda
   b. American Insulated Wire Corp.
   c. Southwire
   d. General Cable

2. Connectors for Wires and Cable Conductors:
   a. AMP
   b. 3M Company
   c. O-Z/Gedney Co.
   d. Square D Company

2.02 WIRES AND CABLES

A. General: Provide wire and cable suitable for the temperature, conditions and location where installed.

B. Conductors: Provide solid or stranded conductors for power and lighting circuits No. 10 AWG and smaller. Provide stranded conductors for sizes no. 8 AWG and larger.

C. All Secondary Service, Panelboards, Switchboard and Transformer feeders to be continuous color cable.

D. Conductor Material: copper for all wires and cables.

E. Insulation: Provide THHN/THWN insulation for all conductors.

F. Color coding for phase identification in accordance with Table 1 in Part 3 below.

G. Jackets: Factory-applied nylon or PVC external jacketed wires and cables for pulls in raceways over 100-feet in length, for pulls in raceways with more than three equivalent 90 deg. bends, for pulls in conduits underground or under slabs on grade, and where indicated.

H. Cables: Provide the following type(s) of cables in NEC approved locations and applications where indicated. Provide cable UL listed for particular application:
   1. Plenum Rated Cable: Type CL2P or CL3P and PLTC.
   2. Portable Cord: Type S.

2.03 CONNECTORS FOR CONDUCTORS

A. Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.
PART 3 - EXECUTION

3.01 WIRING METHOD
A. Use the following wiring methods as indicated:
   1. Wire: Install all wire in raceway.

3.02 INSTALLATION OF WIRES AND CABLES
A. General: Install electrical cables, wires, and connectors in compliance with NEC.
B. Coordinate cable installation with other Work.
C. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.
D. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips, which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.
E. Conceal all cable in finished spaces.
F. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours, where possible.
G. Keep conductor splices to minimum.
H. Install splice and tap connectors, which possess equivalent or better mechanical strength and insulation rating than conductors being spliced.
I. Use splice and tap connectors which are compatible with conductor material.
J. Provide adequate length of conductors within electrical enclosures and trim the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than no. 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.
K. The number of wires for lighting and receptacle branch circuits are not shown on the drawings. The number of wires in any circuit shall be determined in accordance with the National Electrical Code and wiring shall be provided to perform all functions of the devices being installed. Additionally, wires shall be provided as required by the contract documents, i.e. equipment grounds, etc. Provide the number of wires required for a complete and workable system.
L. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A.

3.03 FIELD QUALITY CONTROL
A. Prior to energizing, check installed wires and cables with megohm meter to determine insulation resistance levels to assure requirements are fulfilled.
B. Prior to energizing, test wires and cables for electrical continuity and for short-circuits.
C. Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.
TABLE 1: Color Coding for Phase Identification:

1. All Secondary Service, Panelboards, Switchboard and Transformer feeders to be continuous color cable. Continuous color cable is to be factory applied; no sheath applied over cable is allowed.

2. Color code branch circuit conductors with factory applied color as follows:

<table>
<thead>
<tr>
<th>208y/120 Volts</th>
<th>Phase</th>
<th>480y/277 Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>A</td>
<td>Brown</td>
</tr>
<tr>
<td>Red</td>
<td>B</td>
<td>Orange</td>
</tr>
<tr>
<td>Blue</td>
<td>C</td>
<td>Yellow</td>
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<tr>
<td>White</td>
<td>Neutral</td>
<td>Gray</td>
</tr>
<tr>
<td>Green</td>
<td>Ground</td>
<td>Green</td>
</tr>
</tbody>
</table>

END OF SECTION 260519
SECTION 260526 - GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Requirements of the following Division 26 Sections apply to this Section:
   1. "Basic Electrical Requirements."

1.02 SUMMARY

A. This Section includes solid grounding of electrical systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.

B. Related Sections: The following Sections contain requirements that relate to this section:
   1. Division 26 Section "Wires and Cables".
   2. Division 26 Section "Switchboards".
   3. Division 26 Section "Panelboards".
   4. Division 26 Section "Transformers".

1.03 SUBMITTALS

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

B. Product data for ground rods, connectors and connection materials, and grounding fittings.

C. Field-testing organization certificate, signed by the Contractor, certifying that the organization performing field tests complies with the requirements specified in Quality Assurance below.

D. Report of field tests and observations certified by the testing organization.

1.04 QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.

B. Field-Testing Organization Qualifications: To qualify for acceptance, the independent testing organization must demonstrate, based on evaluation of organization-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated.

C. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code" (NEC).

D. UL Standard: Comply with UL 467, "Grounding and Bonding Equipment".
PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Manufacturers: Subject to compliance with requirements, provide products by the following:
      1. O-Z/Gedney Co.
      2. Raco, Inc.
      3. Thomas & Betts Corp.

2.02 GROUNDING AND BONDING PRODUCTS
   A. Products: Of types indicated and of sizes and ratings to comply with NEC. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.
   B. Conductor Materials: Copper.

2.03 WIRE AND CABLE CONDUCTORS
   A. General: Comply with Division 16 Section "Wires and Cables". Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
   B. Equipment Grounding Conductor: Green insulated.
   C. Grounding Electrode Conductor: Stranded cable.
   D. Bare Copper Conductors: Conform to the following:
      1. Solid Conductors: ASTM B-3

2.04 MISCELLANEOUS CONDUCTORS
   A. Ground Bus: Bare annealed copper bars of rectangular cross section.
   B. Braided Bonding Jumpers: Copper tape, braided No. 30 gauge bare copper wire, terminated with copper ferrules.
   C. Bonding Strap Conductor/Connectors: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

2.05 CONNECTOR PRODUCTS
   A. General: Listed and labeled as grounding connectors for the materials used.
   B. Pressure Connectors: High-conductivity-plated units.
   C. Bolted Clamps: Heavy-duty units listed for the application.
   D. Burndy Hyground provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.
2.06 GROUNDING ELECTRODES
   A. Ground Rods: Copper-clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core.
      1. Size: 3/4 inch by 10 feet.
   B. Plate Electrodes: Copper plates, minimum 0.10 inch thick, size as indicated.

PART 3 - EXECUTION

3.01 APPLICATION
   A. Equipment Grounding Conductor Application: Comply with NEC Article 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.
      1. Install separate insulated equipment grounding conductors with circuit conductors in all electrical raceways to effectively ground all panels, receptacles, motors, disconnect switches, lights, etc.
      2. Nonmetallic Raceways: Install insulated equipment ground conductor in nonmetallic raceways unless they are designated for telephone or data cables.
      3. Air Duct Equipment Circuits: Install an insulated equipment-grounding conductor to duct-mounted electrical devices operating at 120-V and above including heaters. Bond the conductor to each such unit and to the air duct.
   B. Underground Conductors: Bare, tinned, stranded copper except as otherwise indicated.
   C. Low Voltage and Communications: For low voltage systems, provide a #4 AWG minimum green insulated copper conductor in raceway from the grounding electrode system to each terminal cabinet or central equipment location.
   D. Separately derived systems required by NEC to be grounded shall be grounded in accordance with NEC paragraph 250-25.
   E. Metal Poles Supporting Outdoor Lighting Fixtures: Ground pole to a grounding electrode as indicated in addition to separate equipment grounding conductor run with supply branch circuit.

3.02 INSTALLATION
   A. General: Ground electrical systems and equipment in accordance with NEC requirements except where the Drawings or Specifications exceed NEC requirements.
   B. Ground Rods: Locate a minimum of one-rod length from each other and at least the same distance from any other grounding electrode. Interconnect ground rods with bare conductors buried at least 24 inches below grade. Connect bare-cable ground conductors to ground rods by means of exothermic welds except as otherwise indicated. Make these connections without damaging the copper coating or exposing the steel. Use 3/4-inch by 10-ft. ground rods except as otherwise indicated. Drive rods until tops are 6 inches below finished floor or final grade except as otherwise indicated.
   C. Metallic Water Service Pipe: Provide insulated copper ground conductors, sized as indicated, in conduit from the building main service equipment, or the ground bus, to main metallic water service entrances to the building. Connect ground conductors to the main metallic water service pipes by means of ground clamps. Where a dielectric main water
fitting is installed, connect the ground conductor to the street side of the fitting. Do not install a grounding jumper around dielectric fittings. Bond the ground conductor conduit to the conductor at each end.

D. Braided-Type Bonding Jumpers: Install to connect ground clamps on water meter piping to bypass water meters electrically. Use elsewhere for flexible bonding and grounding connections.

E. Route grounding conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.

3.03 CONNECTIONS

A. General: Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.

2. Make connections with clean bare metal at points of contact.

3. Aluminum to steel connections shall be with stainless steel separators and mechanical clamps.

4. Aluminum to galvanized steel connections shall be with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.

B. Burndy Hyground Connections: Use for connections to structural steel and for underground connections except those at test wells. Install at connections to ground rods and plate electrodes. Comply with manufacturers written recommendations.

C. Terminate insulated equipment-grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.

D. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted-and clamped-type connections between conductors and ground rods.

F. Compression-Type Connections: Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.
G. Moisture Protection: Where insulated ground conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.

3.04 FIELD QUALITY CONTROL

A. Independent Testing Organization: Arrange and pay for the services of a qualified independent electrical testing organization to perform tests described below.

B. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground resistance level is specified and at service disconnect enclosure ground terminal. Measure ground resistance without the soil being moistened by any means other than natural precipitation or natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method in accordance with Section 9.03 of IEEE 81, "Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System."

C. Ground/resistance maximum values shall be as follows:

1. Equipment rated 500 kVA and less: 10 Ohms
2. Equipment rated 500 kVA to 1000 kVA: 5 Ohms
3. Equipment rated over 1000 kVA: 3 Ohms

D. Deficiencies: Where ground resistances exceed specified values, and if directed, modify the grounding system to reduce resistance values. Where measures are directed that exceed those indicated the provisions of the Contract, covering changes will apply.

E. Report: Prepare test reports, certified by the testing organization, of the ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

END OF SECTION 260526
SECTION 260529 - SUPPORTING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   B. Requirements of the following Division 26 Sections apply to this Section:
      1. "Basic Electrical Requirements"

1.02 SUMMARY
   A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.
   B. Related Sections: The following sections contain requirements that relate to this section:
      1. Division 3 Concrete for inserts, anchors, and sleeves to be installed in concrete for use with supporting devices.
      2. Division 5 Metals for requirements for miscellaneous metal items involved in supports and fastenings.
      3. Division 7 Thermal and Moisture Protection for requirements for firestopping at sleeves through walls and floors that are fire barriers.

1.03 SUBMITTALS
   A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
   B. Product data for each type of product specified.

1.04 QUALITY ASSURANCE
   A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code".
   B. Electrical components shall be listed and labeled by UL, ETL, CSA or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1. Slotted Metal Angle and U-Channel Systems:
         a. B-Line Systems, Inc.
         b. GS Metals Corp.
         c. Haydon Corp.
         d. Unistrut Diversified Products
2. Conduit Sealing Bushings:
   a. Bridgeport Fittings, Inc.
   b. Cooper Industries, Inc.
   d. GS Metals Corp.
   f. Madison Equipment Co.
   g. L.E. Mason Co.
   h. O-Z/Gedney
   i. Producto Electric Corp.
   j. Raco, Inc.
   k. Red Seal Electric Corp.
   l. Spring City Electrical Mfg. Co.
   m. Thomas & Betts Corp.

2.02 COATINGS
A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

2.03 MANUFACTURED SUPPORTING DEVICES
A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners: Types, materials, and construction features as follows:
   1. Expansion Anchors: Carbon steel wedge or sleeve type.
   2. Toggle Bolts: All steel springhead type.

C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

D. U-Channel Systems: 16-gauge steel channels, with 9/16-in-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with &-channel and are of the same manufacture.

2.04 FABRICATED SUPPORTING DEVICES
A. General: Shop-or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.
C. Pipe Sleeves: Provide pipe sleeves of one of the following:
   1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gauge metal for sleeve diameter noted:
      a. 3-inch and smaller: 20-gauge.
      b. 4-inch to 6-inch: 16-gauge.
   2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

B. Coordinate with the building structural system and with other electrical installation.

C. Raceway Supports: Comply with the NEC and the following requirements:
   1. Conform to manufacturer's recommendations for selection and installation of supports.
   2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs., provide additional strength until there is a minimum of 200 lbs. safety allowance in the strength of each support.
   3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
   4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
   5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
   6. Space supports for raceways in accordance with Table I of this section. Space supports for raceway types not covered by the above in accordance with NEC.
   7. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.
   8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.
D. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

E. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

F. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. For sleeves through fire-rated wall or floor construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduits and cables in accordance with "Fire Resistant Joint Sealers" requirement of Division 7 Thermal and Moisture Protection.

G. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

H. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

2. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration-and shock-resistant fasteners for attachments to concrete slabs.

END OF SECTION 260529
SECTION 260533 - RACEWAYS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   B. Requirements of the following Division 26 Sections apply to this Section:
      1. "Basic Electrical Requirements."

1.02 SUMMARY
   A. This Section includes raceways for electrical wiring. Types of raceways in this section include the following:
      1. Electrical metallic tubing (EMT).
      2. Flexible metal conduit.
      3. Intermediate metal conduit.
      4. Liquidtight flexible conduit.
   B. Related Sections: The following Division 26 Sections contain requirements that relate to this section:
      1. "Wires and Cables" for other wiring methods.
      3. "Electrical Boxes and Fittings" for boxes used with conduit and tubing systems.

1.03 SUBMITTALS
   A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
   B. Product data for the following products:
      1. Surface raceway and fittings.
   C. Samples, 6 inches long of each type and size of surface raceway with required finish.
   D. Installation Instructions: Manufacturer's written installation instructions for surface raceway products.

1.04 QUALITY ASSURANCE
   A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."
   B. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
   C. UL Compliance and Labeling: Comply with applicable requirements of UL standards pertaining to electrical raceway systems. Provide raceway products and components listed and labeled by UL, ETL, or CSA.
1.05 SEQUENCING AND SCHEDULING
   A. Coordinate with other Work, including metal and concrete deck installation, as necessary to interface installation of electrical raceways and components with other Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   B. Conduit Bodies:
      1. Adalet-PLM
      2. O-Z/Gedney
      3. Appleton Electric Co.
      4. Carlon
      5. Crouse-Hinds Division, Cooper Industries, Inc.

2.02 METAL CONDUIT AND TUBING
   A. Intermediate Steel Conduit: UL 1242.
   B. Electrical Metallic Tubing and Fittings: ANSI C80.3.
   C. Flexible Metal Conduit: UL 1, zinc-coated steel.
   D. Liquidtight Flexible Metal Conduit and Fittings: UL 360. Fittings shall be specifically approved for use with this raceway.

2.03 NONMETALLIC CONDUIT AND DUCTS
   A. PVC Conduit and Tubing Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.
   B. Liquidtight Flexible Nonmetallic Conduit and Fittings: UL 1660. Fittings shall be specifically approved for use with this raceway.
   C. Conduit, Tubing and Duct Accessories: Types, sizes and materials complying with manufacturers published product information. Mate and match accessories with raceway.

2.04 CONDUIT BODIES
   A. General: Types, shapes, and sizes as required to suit individual applications and NEC requirements. Provide matching gasketed covers secured with corrosion-resistant screws.
   B. Metallic Conduit and Tubing: Use metallic conduit bodies. Use bodies with threaded hubs for threaded raceways.
   C. Conduit Bodies 1 Inch and Smaller: Use bodies with compression-type EMT connectors.
   D. Nonmetallic Conduit and Tubing: Use nonmetallic conduit bodies conforming to UL 514 B.
PART 3 - EXECUTION

3.01 WIRING METHOD

A. Outdoors: Use the following wiring methods:
   1. Exposed: intermediate metal conduit or rigid metal conduit painted a color as directed.
   2. Connection to Vibrating Equipment: Including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment: liquidtight flexible metal conduit.

B. Indoors: Use the following wiring methods:
   1. Connection to Vibrating Equipment: Including transformers and hydraulic, pneumatic, or electric solenoid or motor-operated equipment: flexible metal conduit.
   2. Exposed: electrical metallic tubing.
   4. Outlet boxes:
      a. Metal stud walls – caddy screw gun brackets “TSGB” or “SGB” installed with screw gun.
      b. Wood stud – caddy screw on box support clips “350”.
   5. Switch boxes:
      a. Metal stud – caddy quick mount box support “HS3”.

3.02 INSTALLATION

A. General: Install electrical raceways in accordance with manufacturer's written installation instructions, applicable requirements of NEC, and as follows:

B. Conduit smaller than 3/4” shall not be used on this project, unless specifically shown on the drawings. Conduit used for switchlegs can be 1/2” c.

C. Conceal Conduit and EMT, unless indicated otherwise, within finished walls, ceilings, and floors. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install raceways level and square and at proper elevations.

D. Elevation of Raceway: Where possible, install horizontal raceway runs above water and steam piping.

E. Complete installation of electrical raceways before starting installation of conductors within raceways.

F. Provide supports for raceways as specified elsewhere in Division 26.

G. Prevent foreign matter from entering raceways by using temporary closure protection.

H. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

I. Make bends and offsets so the inside diameter is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plant and the straight legs of offsets parallel.

J. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as other wise indicated.
K. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions except as otherwise indicated. This does not apply to conduits in crawl spaces.

L. Install exposed raceways parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical.

M. Run exposed, parallel, or banked raceways together. Make bends in parallel or banked runs from the same centerline so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel. This requires that there be a change in the plane of the run such as from wall to ceiling and that the raceways be of the same size. In other cases provide field bends for parallel raceways.

N. Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.

O. Tighten setscrews of threadless fittings with suitable tool.

P. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.

Q. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

R. Install pull wires in empty raceways. Use no. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb. tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.

S. Low Voltage Raceways 2-Inch Trade Size and Smaller: In addition to the above requirements, install raceways 2-inch and smaller trade size in maximum lengths at 150 feet and with a maximum of two, 90-deg. bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements.

T. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill then with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings where required by the NEC, including where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.

U. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver-operated threaded flush plugs flush with floor.
V. Flexible Connections: Use short length (maximum of 6 ft.) of flexible conduit for recessed and semi-recessed lighting fixtures, for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet locations. Install separate ground conductor across flexible connections.

W. Do not install aluminum conduit embedded in or in contact with concrete.

X. Conduit runs are not shown to allow this contractor to choose his own route to the various electrical devices. However, care shall be taken to coordinate the conduit runs with ductwork, beams, joists, etc., to be installed by other contractors. Homeruns cannot be combined without Engineer's approval.

Y. Conduit bends shall be held to as large a radius as possible for ease in pulling of conductors, and to provide a neatly installed appearance. Except where conduit runs are shown on the Drawings, pull boxes shall be installed when conduit runs exceed 200 feet and/or total number of bends exceeds 180 degrees.

3.03 ADJUSTING AND CLEANING

A. Upon completion of installation of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt and construction debris.

END OF SECTION 260533
SECTION 260534 - BOXES, CABINETS AND FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Requirements of the following Division 26 Sections apply to this Section:

1. "Basic Electrical Requirements."

1.02 SUMMARY

A. This Section includes boxes, cabinets, and fittings for electrical installations and certain types of electrical fittings not covered in other sections. Types of products specified in this Section include:

1. Outlet and device boxes.
2. Pull and junction boxes.
3. Floor boxes and service fittings.
5. Hinged door enclosures.
6. Exterior weatherproof in-use box.

B. Conduit-body-type electrical enclosures and wiring fittings are specified in Division 26 Section "Raceways."

1.03 DEFINITIONS

A. Cabinets: An enclosure designed either for surface or for flush mounting and having a frame, or trim in which a door or doors may be mounted.

B. Device Box: An outlet box designed to house a receptacle device or a wiring box designed to house a switch.

C. Enclosure: A box, case, cabinet, or housing for electrical wiring or components.

D. Hinged Door Enclosure: An enclosure designed for surface mounting and having swinging doors or covers secured directly to and telescoping with the walls of the box.

E. Outlet Box: A wiring enclosure where current is taken from a wiring system to supply utilization equipment.

F. Wiring Box: An enclosure designed to provide access to wiring systems or for the mounting of indicating devices or of switches for controlling electrical circuits.

1.04 SUBMITTALS

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

1. Product data for cabinets and enclosures with classification higher than NEMA 1.
2. Shop drawings for floor boxes and boxes, enclosures and cabinets that are to be shop fabricated, (nonstock items). For shop fabricated junction and pull boxes, show accurately scaled views and spatial relationships to adjacent equipment. Show box types, dimensions, and finishes.
1.05 QUALITY ASSURANCE
   A. UL Listing and Labeling: Items provided under this section shall be listed and labeled by UL.
   B. National Electrical Code Compliance: Components and installation shall comply with NFPA 70 "National Electrical Code."
   C. NEMA Compliance: Comply with NEMA Standard 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1. Floor Boxes:
         a. Hubbell
         b. Wiremold
      2. Cabinets:
         c. Square D Co.

2.02 BOXES, CABINETS AND FITTINGS, GENERAL
   A. Electrical Cabinets, Boxes and Fittings: Of indicated types, sizes and NEMA enclosure classes. Where not indicated, provide units of types, sizes and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations.

2.03 MATERIALS AND FINISHES
   A. Sheet Steel: Flat-rolled, code-gage, galvanized steel.
   B. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.
   C. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.
   D. Cast Metal for Boxes, Enclosures and Covers; Copper-free aluminum except as otherwise specified.
   E. Exterior Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.
   F. Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connectors.

2.04 OUTLET, DEVICE, AND SMALL WIRING BOXES
   A. General: Conform to UL 514A, "Metallic Outlet Boxes, Electrical," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size and depth to suit each location and application.
B. Steel Boxes: Conform to NEMA OS1, "Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports." Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.

C. Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

D. Cast-Iron Floor Boxes: Fully adjustable, waterproof, with threaded raceway entrances, adjusting rings, gaskets, and brass floor plates. Where indicated, provide multi-section boxes with individual hinged section covers and provide for a duplex receptacle under one or more of the covers.

E. Weatherproof Receptacle in-use Box: Non-metallic impact resistant polycarbonate with transparent cover. NEMA 3R rated. Closed-cell foam gasket. Meets OHSA lockout/tagout requirements. Latching cover with large cord openings. Meets NEC 410-57(b) requirements for unattended use. Hubbell-Kellems #WP26MP.

2.05 PULL AND JUNCTION BOXES

A. General: Comply with UL 50, "Electrical Cabinets and Boxes", for boxes over 100 cubic inches volume. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.

B. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.

C. Hot-Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot-dip galvanized after fabrication. Cover shall be gasketed.

D. Cast-Iron Boxes: Molded of cast iron alloy with gasketed cover and integral threaded conduit entrances.

2.06 CABINETS

A. Comply with UL 50, "Electrical Cabinets and Boxes."

B. Construction: Sheet steel, NEMA 1 class except as otherwise indicated. Cabinet shall consist of a box and a front consisting of a one piece frame and a hinged door. Arrange door to close against a rabbet placed all around the inside edge of the frame, with a uniformly close fit between door and frame. Provide concealed fasteners, not over 24-inches apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24-inches apart and not over 6-inches from top and bottom of door. For flush cabinets, make the front approximately 3/4 inch larger than the box all around. For surface mounted cabinets make front same height and width as box.

C. Doors: Double doors for cabinets wider than 24-inches. Telephone cabinets wider than 48-inches may have sliding or removable doors.

D. Locks: Combination spring catch and key lock, with all locks for cabinets of the same system keyed alike. Locks may be omitted on signal, power and lighting cabinets located within wire closets and mechanical-electrical rooms. Locks shall be of a type to permit doors to latch closed without locking.
2.07 STEEL ENCLOSURES WITH HINGED DOORS

A. Comply with UL 50, "Cabinets and Enclosures" and NEMA ICS 6, "Enclosures for Industrial Controls and Systems."

B. Construction: Sheet steel, 16-gauge minimum, with continuous welded seams. NEMA class as indicated; arranged for surface mounting.

C. Doors: Hinged directly to cabinet and removable, with approximately 3/4-inch flange around all edges, shaped to cover edge of box. Provide handle operated, key locking latch. Individual door width shall be no greater than 24-inches. Provide multiple doors where required.

D. Mounting Panel: Provide painted removable internal mounting panel for component installation.

E. Enclosure: NEMA 12 except as indicated. Where door gasketing is required, provide neoprene gasket attached with oil-resistant adhesive, and held in place with steel retaining strips. For all enclosures of class higher than NEMA 1, use hubbed raceway entrances.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Locations: Install items where indicated and where required to suit code requirements and installation conditions.

B. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.

C. Support and fasten items securely in accordance with Division 26 Section "Supporting Devices."

D. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.

E. Remove sharp edges where they may come in contact with wiring or personnel.

3.02 APPLICATIONS

A. Cabinets: Flush mounted, NEMA enclosure type 1 except as otherwise indicated.

B. Hinged Door Enclosures: NEMA type 12 enclosure except as indicated.

C. Hinged Door Enclosures Outdoors: Install drip hood, factory tailored to individual units.

D. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements:

   1. Interior Dry Locations: Sheet steel, NEMA type 1.
   2. Locations Exposed to Weather or Dampness: Cast metal, NEMA type 4X.

E. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location except as otherwise indicated.

F. Floor Boxes: In slabs use concrete-tight NEMA 1 boxes.
3.03 INSTALLATION OF OUTLET BOXES

A. Outlet Box Location: Outlet boxes shall be located so they are not placed back-to-back in the same wall in order to limit sound transmission from room to room.

B. Outlets at Windows and Doors: Locate close to window trim. For outlets indicated above doors use 6'-9" mounting height above finished floor and center outlets above the door opening except as otherwise indicated.

C. Column and Pilaster Locations: Locate outlet boxes for switches and receptacles on columns or pilasters so the centers of the columns are clear for future installation of partitions.

D. Locations in Special Finish Materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install such boxes without plaster rings. Saw cut all recesses for outlet boxes in exposed masonry walls.

E. Gasketed Boxes: At the following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:
   1. Exterior locations.
   2. Where surface mounted on unfinished walls, columns, or pilasters. (Cover gaskets may be omitted in dry locations).
   3. Where exposed to moisture-laden atmosphere.
   4. Where indicated.

F. Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

G. Mounting: Mount outlet boxes for switches with the long axis vertical or as indicated. Mount boxes for receptacles vertically unless noted otherwise. Three or more gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on the side opposite the hinges and close to door trim, even though electrical floor plans may show them on hinge side.

H. Ceiling Outlets: For fixtures, where wiring is concealed, use outlet boxes 4-inches square by 1-1/2-inches deep, minimum.

I. Cover plates for Surface Boxes: Use plates sized to box front without overlap.

J. Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.

K. Concrete Boxes: Use extra deep boxes to permit side conduit entrance without interfering with reinforcing, but do not use such boxes with over 6-inch depth.

L. Floor Boxes: Install in concrete floor slabs so they are completely enveloped in concrete except for the top. Where normal slab thickness will not envelop box as specified above, provide increased thickness of the slab. Provide each compartment of each floor box with grounding terminal consisting of a washer-in-head machine screw, not smaller than no. 10-32, screwed into a tapped hole in the box. Adjust covers of floor boxes flush with finished floor.
3.04 INSTALLATION OF PULL AND JUNCTION BOXES

A. Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8-inches square by 4-inches deep. Do not exceed 6 entering and 6 leaving raceways in a single box. Quantities of conductors (including equipment grounding conductors) in pull or junction box shall not exceed the following:

<table>
<thead>
<tr>
<th>Size of Largest Conductors in Box</th>
<th>Maximum # of Conductors in Box</th>
</tr>
</thead>
<tbody>
<tr>
<td># 4/0</td>
<td>AWG 30</td>
</tr>
<tr>
<td>250 MCM</td>
<td>20</td>
</tr>
<tr>
<td>500 MCM</td>
<td>15</td>
</tr>
</tbody>
</table>

1. Cable supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30-inches inside boxes.

2. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling.

3. Size: Provide pull and junction boxes for telephone, signal, and other systems at least 50 percent larger than would be required by Article 370 of NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

3.05 INSTALLATION OF CABINETS AND HINGED DOOR ENCLOSURES

A. Mount with fronts straight and plumb

B. Install with tops 72-inches above floor.

C. Set cabinets in finished spaces flush with walls.

3.06 GROUNDING

A. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box or enclosure.

3.07 CLEANING AND FINISH REPAIR

A. Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions and weld marks.

B. Galvanized Finish: Repair damage using a zinc-rich paint recommended by the manufacturer.

C. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating.

END OF SECTION 260534
SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Requirements of the following Division 26 Sections apply to this Section:
   1. "Basic Electrical Requirements."

1.02 SUMMARY
A. This Section includes identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including but not limited to the following:
   1. Identification labeling for raceways, cables, and conductors.
   2. Operational instruction signs.
   3. Warning and caution signs.
   4. Equipment labels and signs.
B. Related Sections: The following Sections contain requirements that relate to this section:
   1. Division 26 Section "Wires and Cables" for requirements for color-coding of conductors for phase identification.
C. Refer to other Division 26 sections for additional specific electrical identification associated with specific items.

1.03 SUBMITTALS
A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
B. Product data for each type of product specified.

1.04 QUALITY ASSURANCE
A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Panduit Corp.
   2. Standard Signs, Inc.
   3. W.H. Brady, Co.
2.02 ELECTRICAL IDENTIFICATION PRODUCTS

A. Adhesive Marking Labels for Raceway and Metal-clad Cable: Pre-printed, flexible, self-adhesive labels with legend indicating voltage and service (Emergency, Communications, Control).

B. Label Size: as follows:
   2. Raceways Larger than 1-Inch: 1-1/8 inches high by 8 inches long.

C. Color: Black legend on orange background.

D. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.

E. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Raceway and Cable Identification: Flexible acrylic bands sized to suit the raceway diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the raceway or cable.

F. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

G. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in white letters on black face and punches for mechanical fasteners.

H. Baked-Enamel Warning and Caution Signs for Interior use: Preprinted aluminum signs, punched for fasteners, with colors, legend, and size appropriate to the location.

I. Exterior Metal-Baked Butyrate Warning and Caution Signs: Weather-resistant, nonfading, preprinted cellulose acetate butyrate signs with 20-gage, galvanized steel backing, with colors, legend, and size appropriate to the location. Provide 1/4-inch grommets in corners for mounting.

J. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

K. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50 deg. F. to 350 deg. F. Provide ties in specified colors when used for color-coding.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.

B. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.

C. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
D. Conduit Identification:
   1. Identify Raceways of Certain Systems with Color Banding: Band exposed or accessible raceways of the following systems for identification. Bands shall be pretensioned, snap-around colored plastic sleeves, colored adhesive marking tape, or a combination of the two. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side. Install bands at changes in direction, at penetrations of walls and floors, and at 40-foot maximum intervals in straight runs. Apply the following colors:
      a. Communication System: Blue
      b. Sound System: Gray
      c. Access Control and Security: Purple

E. Identify Junction, Pull, and Connection Boxes: Code-required caution sign for boxes shall be pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange background. Install on outside of box cover.

F. Receptacle coverplate to be labeled with permanent ink marker on the reverse side with panel board and circuit information. The coverplate front to be labeled with clear tape and black letters.

G. Install line marker for underground wiring both direct-buried and in raceway.

H. Use conductors with color factory-applied the entire length of the conductors except as follows (Secondary Service, Panelboards, and Transformers exempt):
   1. The following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
      a. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.
      b. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

I. Apply warning, caution, and instruction signs and stencils as follows:
   1. Install warning, caution, or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

J. Install equipment/system circuit/device identification as follows:
   1. Apply equipment identification labels of engraved plastic-laminate on each major unit of electrical equipment in building, including central or master unit of each
electrical system. This includes communication/signal/alarm systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 1/2-inch-high lettering on 1-1/2-inch-high label (2-inch-high where two lines are required), white lettering in black field. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each unit of the following categories of electrical equipment.

a. Panelboards, electrical cabinets, and enclosures.
b. Motor starters.
c. Pushbutton stations.
d. Contactors.
e. Control devices.
f. Transformers.

K. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

L. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

END OF SECTION 260553
SECTION 260925 - OCCUPANCY SENSORS

PART 1 - GENERAL

1.01 OCCUPANCY DETECTION TECHNOLOGY REQUIREMENTS

A. The occupancy sensor system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.

B. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.

C. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.

D. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.

E. All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

1.02 OCCUPANCY SENSOR OPERATION REQUIREMENTS

A. Sensors shall offer a minimum on timer of at least 15 minutes, in order to prevent all cycling of lamps before they have burned for the lamp manufacturers minimum recommended time period. This timer shall be in addition to the regular occupancy time delay that keeps lights on after last detected occupancy. User shall be able to disable/enable and change the value of this timer.

B. Sensors shall utilize an occupancy time delay that keeps lights on after last detected occupancy. Factory default setting of the occupancy time delay shall be 10 minutes. Sensors with a longer factory default setting shall not be permitted as they greatly restrict energy savings potential.

C. Manual adjustment to the occupancy time delay so as to increase it shall be accommodated, but shall not be allowed unless a calculation showing the resulting energy savings loss is presented to the building owner and specifying engineer.

D. Automatic adjustments to the occupancy time delay shall only be permitted if the controlling algorithm maximizes both lamp life and energy savings. For example a shorter more energy saving time delay setting shall only be allowed if the resulting lamp life is also improved.

E. Installer, in accordance with manufacturer’s recommendation, shall determine final sensor location. All sensors shall be factory calibrated for optimum performance for its installed PIR lens, and shall not require initial or subsequent field adjustment of detection sensitivity.
F. All sensor setting adjustments shall be digital and made using a push-button. Dip switches, analog dials, and/or the need for tools of any kind shall not be accepted.

G. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.03 MISC REQUIREMENTS

A. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing. Manufacturing facility must be ROHS compliant.

B. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.

C. All applicable products must be UL / CUL Listed or other acceptable national testing organization.

D. Sensors shall have a 5 year warranty.

1.04 APPROVED MANUFACTURER AND SUBSTITUTIONS

A. Approved manufacturers are Sensor Switch, Leviton, Eaton and Watt Stopper.

1.05 SUBMITTALS:

A. An AutoCAD drawing of the facility showing coverage patterns and technical data must be provided with submittals. Installation drawings indicating locations of all devices and wiring diagrams to be provided.

PART 2 – PRODUCTS

2.01 WALL SWITCH OCCUPANCY SENSORS – SMALL AREAS

A. Sensor shall provide wall-to-wall PIR detection such that small hand motions are detected out to 20 ft (6.10 m).

B. In areas with periodic or permanent obstruction to a sensor’s field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used.

C. For applications requiring independent control of two loads, a sensor with two dual relays and dual override switches shall be required. Each relay shall have independent programmable occupancy time delays.

D. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, and ¼ HP motor load.

E. Sensor shall recess into single gang switch box and fit a standard GFI opening.

F. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.

G. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.

H. Sensor shall not require a neutral connection regardless of number of poles and/or detection technology (only exception is versions with lighted push-buttons).
I. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (off) condition. Sensor shall not require a minimum load to be connected in order to function.

J. Sensor shall have optional features for photocell/daylight override, vandal resistant lens, low temperature/high humidity operation.

K. All sensor settings, including time delay and photocell settings shall be digital and accessible for adjustment via a push-button without requiring removal of cover plate or tools of any kind.

L. Wall Switch sensors shall have field programmable adjustments for selecting operational modes, occupancy time delays, minimum on time, and photocell set-point as applicable.

M. All models shall be capable of both Auto-On and Manual On operation.

N. All models shall be capable of a “Reduced Turn On” operation where the initial PIR turn on level is higher in order to eliminate PIR from reflective surfaces from being detected. PIR shall be returned to normal levels upon initial PIR detection.

O. All models shall have a “Predictive Off” mode where user can manually turn the lights off when leaving the room and still have them come on automatically when they return to space.

P. All models shall be capable of disabling override switch.


1. WSD (PIR)
2. WSD 2P (PIR, Dual Relays, Auto On Pole 1/Manual On Pole 2)
3. WSD PDT (PIR/Microphonics)
4. WSD PDT 2P (PIR/Microphonics, Dual Relays, On Pole 1/Manual On Pole 2)
5. WSD SA (PIR, Manual On by default)
6. WSD PDT SA (PIR/Microphonics, Manual On by default)
7. WSD NL (PIR, lighted push-button, neutral required)
8. WSD PDT NL (PIR/Microphonics, lighted push-button, neutral required)
9. WSD LV (PIR, low voltage, power pack required)
10. WSD PDT LV (PIR/Microphonics, low voltage, power pack required)

2.02 LOW VOLTAGE OCCUPANCY SENSORS

A. The installing contractor shall install one or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer’s best practice recommendations.

B. In areas with periodic or permanent obstruction to a sensor’s field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used.

C. Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, so as to provide a high degree of RF immunity.

D. Sensors shall interconnect with other sensors and power/relay packs with class 2, three-conductor wire.
E. Sensors shall operate on 12 to 24 VAC or VDC and consume no more than 5 mA so that up to 14 sensors may be connected to a single power pack.

F. Upon initial power up, sensors must immediately turn on. Power packs may be wired on the line or load side of local switching and must not exhibit any delays when switch is energized.

G. Sensors shall have test mode that temporarily shortens/disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.

H. Sensors shall have optional features for on/off photocell control, automatic dimming control photocell, high/low occupancy based dimming, and usage in low temperature/high humidity environments.

I. Reference Standard Sensor Switch model numbers.
   1. **CM 9** (PIR, Ceiling Mount, Standard Range)
   2. **CM PDT 9** (PIR/Microphonics, Ceiling Mount, Standard Range)
   3. **CM 10** (PIR, Ceiling Mount, Extended Range)
   4. **CM PDT 10** (PIR/Microphonics, Ceiling Mount, Extended Range)
   5. **WV 16** (PIR, Corner Mount, Wide View)
   6. **WV PDT 16** (PIR/Microphonics, Corner Mount, Wide View)
   7. **HW13** (PIR, Wall Mount, Hallway View)
   8. **HM 10** (PIR, Surface Mount Box, High Bay Aisle Way)
   9. **CM 6** (PIR, Ceiling Mount, High Bay 360°)

K. Sensors with a recessed profile are acceptable substitutes for above ceiling mount sensors (e.g. **CM 9** => **RM 9**)

L. Fixture mounted box sensors are acceptable substitutes for above ceiling mount sensors (e.g. **CM 9** => **CMB 9**)

2.03 POWER PACKS

A. Power packs shall accept and switch 120 or 277 VAC, be plenum rated, and provide class 2 power for up to 14 remote sensors.

B. Power pack shall securely mount to junction location through a threaded ½ inch chase nipple. Plastic clips into junction box shall not be accepted. All class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

C. When required by local code, power pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

D. Power pack shall incorporate a Class 1 relay and an AC electronic switching device. The AC electronic switching device shall make and break the load, while the relay shall carry the current in the on condition. This system shall provide full 20 Amp switching of all load types, and be rated for 400,000 cycles.
E. Power packs shall be single circuit, or two circuits. Slave packs may be used to control additional circuits. When two circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.

F. Reference Standard Sensor Switch model numbers.
   1. **PP20** (Single Pole)
   2. **PP20 2P** (Two Pole)
   3. **SP20** (Slave Pack)

**PART 3 – EXECUTION**

3.01 **TRAINING:** Two visits – total of eight (8) hours.
SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Requirements of the following Division 26 Sections apply to this Section:
   1. "Basic Electrical Requirements."

1.02 SUMMARY
A. This Section includes lighting and power panelboards and associated auxiliary equipment rated 600 V or less.
B. Related Sections: The following Division 26 Sections contain requirements that relate to this Section:
   1. "Overcurrent Protective Devices" for circuit breakers, fusible switches, fuses, and other devices used in panelboards.

1.03 DEFINITIONS
A. Overcurrent Protective Device (OCPD): A device operative on excessive current that causes and maintains the interruption of power in the circuit it protects.

1.04 SUBMITTALS
A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
B. Product data for each type panelboard, accessory item, and component specified.
C. Shop drawings from manufacturers of panelboards including dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:
   1. Enclosure type with details for types other than NEMA Type 1.
   2. Bus configuration and current ratings.
   4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
D. Wiring diagrams detailing schematic diagram including control wiring, and differentiating between manufacturer-installed and field-installed wiring.
E. Qualification data for field-testing organization certificates, signed by the contractor, certifying that the organization complies with the requirements specified in Quality Assurance below. Include list of completed projects with project names, addresses, and names of architect and Owner plus basic organization qualifications data.
F. Report of field tests and observations certified by testing organization.
G. Panel schedules for installation in panelboards. Submit final versions after load balancing.

H. Maintenance data for panelboard components, for inclusion in Operating and Maintenance Manual specified in Division 1 and in Division 26 Section "Basic Electrical Requirements."
   Include instructions for testing circuit breakers.

1.05 QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
   1. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.

B. Field-Testing Organization Qualifications: To qualify for acceptance, the independent testing organization must demonstrate, based on evaluation of organization-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated.

C. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code" (NEC).

D. NEMA Standard: Comply with NEMA PB1, "Panelboards".

E. UL Standards: Comply with UL 61, "Panelboards", and UL 50, "Cabinets and Boxes".

1.06 EXTRA MATERIALS

A. Keys: Furnish three spares of each type for panelboard cabinet locks.

B. Touch-up Paint for surface-mounted panelboards: One half-pint container.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Cutler-Hammer
   2. General Electric Co. – A Series and Spectra (fused switch).
   3. Siemens/ITE
   4. Square D Co. HQOD and QMB.

2.02 PANELBOARDS, GENERAL REQUIREMENTS

A. Overcurrent Protective Devices (OCPDs): Provide type, rating and features as indicated. Comply with Division 26 Section "Overcurrent Protective Devices", with OCPDs adapted to panelboard installation. Tandem circuit breakers shall not be used. Multipole breakers shall have common trip.

B. Enclosures: Cabinets, flush or surface mounted as indicated. NEMA Type 1 enclosure, except where the following enclosure requirements are indicated.

C. Front: Secured to box with concealed trim clamps except as indicated. Front for surface-mounted panels shall be same dimensions as box. Fronts for flush panels shall overlap box except as otherwise specified.

D. Directory Frame: Metal, mounted inside each panel door.
E. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.

F. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the OCPD ampere ratings indicated for future installation of devices.

G. All buss material to be copper.

2.03 LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS

A. Branch OCPDs: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Double-Width Panels: Where more than 42 poles are indicated or where otherwise indicated, provide two panelboards under single front.

C. Doors: In panel front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.

2.04 DISTRIBUTION PANELBOARDS

A. Doors: In panel front, omit single panelboard door in cabinet front for fusible switch panelboards except as indicated. Secure with vault-type with tumbler lock, all keyed alike.

B. Branch-Circuit Breakers: Where OCPDs are indicated to be circuit breakers, use bolt-on breakers except circuit breakers 225-ampere frame size and greater may be plug-in type where individual positive locking device requires mechanical release for removal.

C. Panelboard must accept circuit breaker sizes up to the buss ampacity rating but not equal to. Example: 400 AMP panel accepts 200 AMP breaker.

2.05 IDENTIFICATION

A. General: Refer to Division 26 Section "Electrical Identification" for labeling materials.

B. Panelboard Nameplates: Engraved laminated plastic or metal nameplate for each panelboard mounted with epoxy or industrial cement or industrial adhesive.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install panelboards and accessory items in accordance with NEMA PB 1.1, "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less" and manufacturers' written installation instructions.

B. Mounting Heights: Top of trim 6'-0" above finished floor, except as indicated.

C. Mounting: Plumb and rigid without distortion of box. Mount flush panels uniformly flush with wall finish.

D. Circuit Directory: Typed and reflective of final circuit changes required to balance panel loads. Obtain approval before installing.

E. Install filler plates in unused spaces.

F. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch empty conduits from panel into accessible ceiling space or space designated to be ceiling space in future. Stub four 1-inch empty conduits into raised floor space or below slab other than slabs on grade.
G. Wiring in Panel Gutters: Train conductors neatly in groups, bundle, and wrap with wire ties after completion of load balancing.

3.02 IDENTIFICATION
A. Identify field-installed wiring and components and provide warning signs in accordance with Division 26 Section "Electrical Identification".

3.03 GROUNDING
A. Connections: Make equipment-grounding connections for panelboards as indicated.
B. Provide ground continuity to main electrical ground bus indicated.

3.04 CONNECTIONS
A. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer's published torque tightening values. Where manufacturers' torquing values are not indicated, use those specified in UL 486A.

3.05 FIELD QUALITY CONTROL
A. Independent Testing Organization: Arrange and pay for the services of a qualified independent electrical testing organization to perform tests on low-voltage power panelboards and accessories.
B. Pretesting: Upon completing installation of the system, perform the following preparations for independent tests:
   1. Make insulation resistance tests of panelboard buses, components, and connecting supply, feeder, and control circuits.
   2. Make continuity tests of circuits.
   3. Provide set of Contract Documents to test organization. Include full updating on final system configuration and parameters where they supplement or differ from those indicated in original Contract Documents.
C. Quality Control Program: Conform to the following:
   1. Procedures: Make field tests and inspections and prepare panelboard for satisfactory operation in accordance with manufacturer's recommendations and these specifications.
   2. Schedule tests with at least one week in advance notification.
   4. Labeling: Upon satisfactory completion of tests and related effort, apply a label to tested components indicating results of tests and inspections, responsible organization and person, and date.
D. Visual and mechanical inspection: Include the following inspections and related work.
   1. Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.
2. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.

3. Check panelboard mounting, area clearances, and alignment and fit of components.

4. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.

5. Perform visual and mechanical inspection and related work for overcurrent protective devices as specified in Division 26 Section "Overcurrent Protective Devices."

E. Electrical Tests: Include the following items performed in accordance with manufacturer's instructions:

1. Ground resistance test on system and equipment ground connections.

2. Test main and subfeed overcurrent protective devices in accordance with Section "Overcurrent Protective Devices".

F. Retest: Correct deficiencies identified by tests and observations and provide retesting of panelboards by testing organization. Verify by the system tests that the total assembly meets specified requirements.

3.06 CLEANING

A. Upon completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

3.07 COMMISSIONING

A. Balancing Loads: After Substantial Completion, but not more than 2 months after Final Acceptance, conduct load-balancing measurements and circuit changes as follows:

1. Perform measurements during period of normal working load as advised by the Owner.

2. Perform load-balancing circuit changes outside the normal occupancy-working schedule of the facility. Make special arrangements with Owner to avoid disrupting critical 24-hour services such as FAX machines and on-line data processing, computing, transmitting, and receiving equipment.

3. Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.

4. Tolerance: Difference between phase loads exceeding 20 percent at any one panelboard is not acceptable. Rebalance and recheck as required to meet this minimum requirement.

END OF SECTION 262416
SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including General and Supplementary
      Conditions and Division 1 Specification Sections, apply to this Section.
   B. Requirements of the following Division 26 Sections apply to this Section:
      1. "Basic Electrical Requirements."

1.02 SUMMARY
   A. This Section includes the following:
      1. Receptacles
      2. Ground Fault Circuit Interrupter Receptacles
      3. A.C. Toggle Switches
      4. Wall Plates
   B. Related Sections: The following sections contain requirements that relate to this section:
      1. Division 26 Section "Circuit and Motor Disconnects: for devices other than A.C. toggle
         switches and plug/receptacle sets used as disconnects for motors.
      2. Division 26 Section "Electrical Identification" for requirements for legends to be
         engraved on wall plates.

1.03 SUBMITTALS
   A. Product data for each type of product specified.

1.04 QUALITY ASSURANCE
   A. Regulatory Requirements: Comply with provisions of the following codes.
   B. NFPA 70 "National Electrical Code."
      1. UL and NEMA Compliance: Provide wiring devices, which are listed and labeled by
         UL, and comply with applicable UL and NEMA standards.

1.05 SEQUENCING AND SCHEDULING
   A. Schedule installation of finish plates after the surface upon which they are installed has
      received final finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the
      following:
      Devices:
      1. Leviton
      2. Pass and Seymour
      3. Hubbell Inc.
Fittings and Boxes:
1. Steel City; Midland-Ross Corp.

2.02 WIRING DEVICES

A. General: Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA standards. Provide ivory color devices except as otherwise indicated. Verify color selections with Architect.

B. RECEPTACLES:
1. Plugtail type receptacle shall be specification grade; duplex; 20 Ampere rating non-tracking plastic case; 120 VAC; ivory color; NEMA reference 5-2OR straight vertical power blades; “U” shaped ground 2 pole-3 wire; back and side wired; separate green grounding screw; triple wipe beryllium copper contacts; 2 circuit “break-off” strip; undercut binder head screws. Pass and Seymour PT5362 and PT5362TR.

2. Receptacle shall be specification grade; duplex; 20 Ampere, non-tracking plastic case; 250 VAC; ivory color; NEMA reference 6-2OR straight horizontal power blades; “U” shaped ground blade; 2 pole-3 wire, back and side wired; separate green grounding screw; triple wipe beryllium copper contacts; 2 circuit “break-off” strip; undercut binder head screws. Hubbell 5451.

3. Receptacle shall be specification grade; single; 30 Ampere, 250 VAC; black color; straight horizontal power blades; “U” shaped grounding blade; 3 pole-4 wire, back wired; separate green grounding screw; NEMA reference 14-30R; complete with cordset and matching plug. Hubbell 9430.

4. Receptacle shall be specification grade; single; 50 Ampere, 250 VAC; black color; straight vertical power blades; “U” shaped grounding blade; 3 pole-4 wire, back wired; separate green grounding screw; NEMA reference 14-50R; complete with cordset and matching plug. Hubbell 9450.

5. Receptacle shall be specification grade; duplex; isolated ground; 20 Ampere rating, non-tracking plastic case; 125 VAC; orange color; 2 pole-3 wire, side wired; undercut binder head screws. Hubbell IG8300.

6. Plugtail ground fault interrupter receptacle shall be 20 Ampere; 125 VAC; duplex; 5-milliampere sensitivity to earth leakage current; reset button device to protect downstream devices. Pass and Seymour PT2095 and PT2095TR.

C. TOGGLE SWITCHES:
1. Plugtail toggle switches shall be specification grade; 120/277 VAC; ivory color for normal circuits; quiet type; back and side wired; non-tracking case; undercut binder head screws; silver-cadmium alloy contacts with bronze spring arm; 20 Ampere rating; SPST,DPST, 3-or 4-way, maintained or momentary contacts, and key operated as indicated by Contract Documents. Pass and Seymour PT20AC1.

2.03 WIRING DEVICE ACCESSORIES

A. Wall plates: single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish.
of plates. Provide wall plates with engraved legend where indicated. Conform to requirements of Section "Electrical Identification: Provide plates possessing the following additional construction features:

1. Device finish plates shall be 0.040” thick-brushed #302 stainless steel; weatherproof units shall have gasketed in-use cover. Provide "Jumbo" oversized wall plates for all devices installed in masonry walls. Hubbell S Series.

PART 3 - EXECUTION

3.01 INSTALLATION OF WIRING DEVICES AND ACCESSORIES:

A. Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other Work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other Work.

C. Install wiring devices only in electrical boxes that are clean, free from building materials, dirt, and debris.

D. Install wiring devices after wiring work is completed.

E. Install wall plates after painting work is completed.

F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A. Use properly scaled torque indicating hand tool.

G. Install receptacle with ground pin mounted in the down position.

3.02 GROUNDING

A. An insulated green conductor wire shall be included with circuit wiring of equal length and connected to the panelboard ground bus.

3.03 PROTECTION

A. Protect installed components from damage. Replace damaged items prior to final acceptance.

3.04 FIELD QUALITY CONTROL

A. Testing: Prior to energizing circuits, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six times.

B. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

END OF SECTION 262726
SECTION 262813 - FUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Requirements of the following Division 26 Sections apply to this Section:
   1. "Basic Electrical Requirements."

1.02 SUMMARY
A. This Section includes fuses rated 600 V and below and accessory items. Types of products in this Section include the following:
   1. Cartridge Fuses.

1.03 QUALITY ASSURANCE
A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."
B. UL Listing and Labeling: Items provided under this Section shall be listed and labeled by UL.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Deliver spare fuses to Owner.

1.05 EXTRA MATERIALS
A. Maintenance Stock, Fuses: For types and ratings required, furnish spare fuses, amounting to one unit for every 5 installed units, but not less than one set of 3 of each kind.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Bussmann Div., Cooper Industries, Inc.
   2. General Electric Co.
   3. Littelfuse, Inc.
   4. Ferraz - Shawmut

2.02 FUSES, GENERAL
A. General: Provide fuses of types, classes, and current ratings as indicated. Voltage ratings shall be consistent with the circuits on which used.
B. Fuses for Direct Current Circuits: Marked for such use by the manufacturer on the fuse label.
2.03 CARTRIDGE FUSES
   A. General: Comply with ANSI/IEEE Standard FU1, "Low Voltage Cartridge Fuses." Provide nonrenewable-cartridge-type fuses except as indicated.
      1. Class L Fuses: Comply with UL 198C, "High-Interrupting Capacity Fuses, Current-Limiting Type.
      2. Class RK1 and RK5 Dual Element Time Delay Fuses: Comply with UL 198E, "Class R Fuses."
      3. Class RK1 Fast Acting Fuses: Comply with UL 198E, "Class R Fuses."

PART 3 - EXECUTION

3.01 APPLICATION OF FUSES
   A. General: Apply fuses as indicated and as follows:
   B. New General Purpose Fusible Switches: Apply the following class and types:
      1. 30-600 Amperes: Class RK1, time delay.
   C. Combination Starters: Class RK1, time delay.
   D. Switches in Switchboards: Apply the following classes and types:
      1. 60-600 Amperes: Class RK1, time delay.
   E. Existing General-Purpose Switches: Apply the following classes and types:
      1. 30-600 Amperes: Class RK1, time delay.

3.02 INSTALLATION
   A. Install fuses in fusible devices as indicated.

END OF SECTION 262813
SECTION 262816 - CIRCUIT AND MOTOR DISCONNECTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   B. Requirements of the following Division 26 Sections apply to this Section:
      1. Basic Electrical Requirements
      2. Fuses

1.02 SUMMARY
   A. This Section includes circuit and motor disconnects.
   B. Related Sections: The following sections contain requirements that relate to this section:
      1. Division 26 Section "Wiring Devices" for A.C. toggle switches used as motor disconnects.

1.03 SUBMITTALS
   A. Product data for each type of product specified.
   B. Maintenance data for circuit and motor disconnects, for inclusion in Operation and Maintenance Manual specified in Division 1 and Division 26 Section "Basic Electrical Requirements."

1.04 QUALITY ASSURANCE
   A. Electrical Component Standards: Provide components complying with NFPA 70 "National Electrical Code" and which are listed and labeled by UL. Comply with UL Standard 98 and NEMA standard KS 1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1. General Electric Co.
      2. Siemens/ITE
      3. Square D Co.
      4. Cutler-Hammer

2.02 CIRCUIT AND MOTOR DISCONNECT SWITCHES
   A. General: Provide circuit and motor disconnect switches in types, sizes, duties, features ratings, and enclosures as indicated. Provide NEMA 1 enclosure except for outdoor switches, and other indicated locations provide NEMA 3R enclosures with rain tight hubs. For motor and motor starter disconnects, provide units with horsepower ratings suitable to the loads.
B. Fusible Switches: heavy-duty switches, with fuses of classes and current ratings indicated. See Section "FUSES" for specifications. Where current limiting fuses are indicated, provide switches with non-interchangeable feature suitable only for current limiting type fuses.

C. Non-fusible Disconnects: heavy-duty switches of classes and current ratings as indicated.

D. Service Switches: heavy-duty fusible switches. UL listed for use as service equipment under UL Standard 98 or 869.

E. Thermal rated non-fused toggle switch for motor loads ¼ horsepower and below to be horsepower rated. Pilot light on for run. Hubbell HBL1221 PL.

2.03 ACCESSORIES

A. Electrical Interlocks: Provide number and arrangement of interlock contacts in switches as indicated.

B. Captive Fuse Pullers: Provide built-in fuse pullers arranged to facilitate fuse removal.

PART 3 - EXECUTION

3.01 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECTS

A. General: Provide circuit and motor disconnect switches as indicated and where required by the above Code. Comply with switch manufacturers' printed installation instructions.

3.02 FIELD QUALITY CONTROL

A. Testing: Subsequent to completion of installation of electrical disconnect switches, energize circuits and demonstrate capability and compliance with requirements. Except as otherwise indicated, do not test switches by operating them under load. However, demonstrate switch operation through six opening/closing cycles with circuit unloaded. Open each switch enclosure for inspection of interior, mechanical and electrical connections, fuse installation, and for verification of type and rating of fuses installed. Correct deficiencies then retest to demonstrate compliance. Remove and replace defective units with new units and retest.

END OF SECTION 262816
SECTION 262830 - OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including General and Supplementary
      Conditions and Division 1 Specification Sections, apply to this Section.
   B. Requirements of the following Division 26 Sections apply to this Section:
      1. "Basic Electrical Requirements."

1.02 SUMMARY
   A. This Section includes overcurrent protective devices (OCPDs) rated 600 V and below and
      switching devices commonly used with them.
   B. Panelboards and Switchboards: Application, installation, and other related requirements for
      overcurrent protective device installations in distribution equipment are specified in other
      Division 26 sections.

1.03 DEFINITIONS
   A. Overcurrent Protective Device (OCPD): A device operative on excessive current that causes
      and maintains the interruption of power in the circuit it protects.
   B. Ampere-Square-Seconds: An expression of available thermal energy resulting from current
      flow. With regard to current-limiting fuses and circuit breakers, the ampere-squared-
      seconds during fault current interruption represents the energy allowed to flow before the
      fuse or breaker interrupts the fault current within its current limiting range.

1.04 SUBMITTALS
   A. General: Submit the following in accordance with Conditions of Contract and Division 1
      Specification Sections.
   B. Product data for fuses, fusible switches, circuit breakers, and OCPD accessories specified in
      this Section, including descriptive data for all protective devices.

1.05 QUALITY ASSURANCE
   A. Electrical Component Standard: Components and installation shall comply with NFPA 70
      "National Electrical Code" (NEC).
   B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
      1. The terms "listed" and "labeled" shall be defined as they are in the National Electrical
         Code, Article 100.
   C. Single-Source Responsibility: Obtain similar OCPDs from a single manufacturer.

1.06 EXTRA MATERIALS
   A. Maintenance Stock, Fuses: For types and ratings required, furnish spare fuses, amounting to
      one unit for every 5 installed units, but not less than one set of 3 of each kind.
PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Fusible Switches:
      a. Cutler-Hammer
      b. General Electric Co.
      c. Siemens/ITE
      d. Square D Co.
   2. Molded-Cast Circuit Breakers:
      a. Cutler-Hammer
      b. General Electric Co.
      c. Siemens/ITE
      d. Square D Co.

2.02 OVERCURRENT PROTECTIVE DEVICES (OCPDs), GENERAL
A. General: Provide OCPDs in indicated types, as integral components of panelboards, switchboards; and also as individually enclosed and mounted single units.
B. Enclosures: NEMA 250 "Enclosures for Electrical Equipment (1,000 Volts Maximum)."
C. Device manufacturer must be the same as the panelboard manufacturer.

2.03 FUSIBLE SWITCHES
A. General: UL 98 "Enclosed and Dead Front Switches: and NEMA KS 1 "Enclosed Switches", quick-make, quick-break heavy-duty units.
B. Rating: Load-breaking capacity in excess of the normal horsepower rating for the switch.
C. Withstand Capability: In excess of the let-through current permitted by its fuse when subject to faults up to 100,000 RMS symmetrical amperes.
D. Operation: By means of external handle.
E. Interlock: Prevents access to switch interior except when in "off" position.
F. Fuse Clips: Rejection type.
G. Padlocking Provisions: For 2 padlocks, whether open or closed.
H. Enclosure for Switchboard or Panelboard Mounting: Suitable for panel mounting where indicated.
I. Enclosure for Independent Mounting: NEMA Type 1 enclosure except as otherwise indicated or required to suit environment where located.

2.04 MOLDED -CASE CIRCUIT BREAKERS
A. General: UL 489, "Molded Case Circuit Breakers and Circuit Breaker Enclosures", and NEMA AB 1, "Molded Case Circuit Breakers."
B. Construction: Bolt-in type, except breakers 225-ampere frame size and larger may be plug-in type if held in place by positive locking device requiring mechanical release for removal.
C. Characteristics: Indicated frame size, trip rating, number of poles, and short-circuit interrupting capacity rating of 22,000 amperes symmetrical, unless a greater rating is indicated.

D. Tripping Device: Quick-make, quick-break toggle mechanism with inverse-time delay and instantaneous overcurrent trip protection for each pole.

E. Enclosure for Switchboard or Panelboard Mounting: Suitable for panel mounting in switchboard or panelboards where indicated.

2.05 OCPD ACCESSORIES

A. Shunt-Trip Devices for Circuit Breakers: Where indicated, arrange to trip breaker from an external source of power through a control switch or relay contacts.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Independently Mounted OCPDs: Locate as indicated in accordance with manufacturer's written installation instructions.

B. OCPDs in distribution equipment shall be factory installed.

3.02 IDENTIFICATION

A. Identify components in accordance with Division 26 Section "Electrical Identification".

3.03 CONNECTIONS

A. Check connectors, terminals, bus joints, and mountings for tightness. Tighten field-connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated. Tighten connectors and terminals to comply with tightening torques specified in UL 486A.

3.04 GROUNDING

A. Provide equipment grounding connections for individually mounted OCPD units as indicated and as required by NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.05 FIELD QUALITY CONTROL

A. Independent Testing Organization: Arrange and pay for the services of a qualified independent electrical testing organization to perform tests described below.

B. Reports: Prepare written reports certified by the testing organization on tests and observations. Report defective materials and workmanship and unsatisfactory test results. Include complete records of repairs and adjustments made.

C. Labeling: Upon satisfactory completion of tests and related effort, apply a label to tested components indicating test results, date, and responsible organization and person.

D. Schedule visual and mechanical inspections and electrical tests with at least one week's advance notification.

E. Pretesting: Upon completing installation of the system, perform the following preparations for independent tests:
1. Make insulation resistance tests of OCPD buses, components, and connecting supply, feeder, and control circuits.

2. Make continuity tests of circuits.

3. Provide set of Contract Documents to test personnel. Include full updating on final system configuration and parameters where they supplement or differ from those indicated in original Contract Documents.

4. Provide manufacturer's instructions for installation and testing of OCPDs to test personnel.

F. Visual and mechanical inspection: Include the following inspections and related work.

1. Overcurrent-Protective-Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system arrangement and parameters. Where discrepancies are found, test organization shall recommend final protective device ratings and settings. Use accepted revised ratings or settings to make the final system adjustments.

2. Inspect for defects and physical damage, UL labeling, and nameplate compliance with current single line diagram.

3. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.

4. Check tightness of electrical connections of OCPDs with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.

5. Clean OCPDs using manufacturer's approved methods and materials.

6. Verify installation of proper fuse types and ratings in fusible OCPDs.

G. Electrical Tests: Include the following items performed in accordance with manufacturer's instructions:

1. Insulation resistance test of OCPD conducting parts. Insulation resistance less than 100 megohms is not acceptable.

2. Check key and other interlock and safety devices for operation and sequence. Make closing attempts on locked-open and opening attempts on locked-closed devices including moveable barriers and shutters.

H. Retest: Correct deficiencies identified by tests and observations and provide retesting of OCPDs by testing organization. Verify by the system tests that specified requirements are met.

3.06 CLEANING

A. Upon completion of installation, inspect OCPDs. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION 262830
SECTION 262913 - MOTOR STARTER/CONTROLLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including General and Supplementary
      Conditions and Division 1 Specification Sections, apply to this Section.
   B. Requirements of the following Division 26 Sections apply to this Section:
      1. Basic Electrical Requirements
      2. Fuses
      3. Electrical Identification

1.02 SUMMARY
   A. This Section includes circuit and motor disconnects.
   B. Related Sections: The following sections contain requirements that relate to this section:
      1. Division 26 Section "Wiring Devices" for snap switches used as motor disconnects.

1.03 SUBMITTALS
   A. Product data for each type of product specified.
   B. Maintenance data for motor starter and controllers, for inclusion in Operation and
      Maintenance Manual specified in Division 1 and Division 26 Section "Basic Electrical
      Requirements."

1.04 QUALITY ASSURANCE
   A. Electrical Component Standards: Provide components complying with NFPA 70 "National
      Electrical Code" and which are listed and labeled by UL. Comply with UL Standard 98 and
      NEMA standard KS 1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the
      following:
      1. General Electric Co.
      2. Siemens/ITE
      3. Square D Co.
      4. Cutler Hammer

2.02 MAGNETIC CONTROLLER
   A. Motor controllers shall be heavy duty; furnished complete with proper size, type and voltage
      thermal motor running protection, holding coils, auxiliary contacts, relays, transformers, etc.,
      as required; units shall be manual or magnetic full or reduced voltage Delta-Wye or
      autotransformer type as indicated by Contract Documents and/or required; non-teasible quick-
      make quick-break mechanism; multi-speed units shall have thermal motor/running protection
      for all speeds; hand-off-automatic selector switch in cover; 115 volt control power transformer
      in each magnetic starter or one transformer adequately sized for all units in a motor control
center with both primary and secondary separately fused; each phase line shall contain a thermal heater element, magnetic units shall have provision for field installation of up to 3 NO and 4 NC interlocks in addition to the hold-in interlock, polyphase units shall include phase-loss sensing and trip to prevent single-phasing of motors, 6-600 second start-up solid state timer for motor 7.5 HP and above, green running pilot lamp.

2.03 ACCESSORIES
   A. Captive Fuse Pullers: Provide built-in fuse pullers arranged to facilitate fuse removal.

2.04 SPARE PARTS
   A. Provide six (6) spare overloads of each type used.

PART 3 - EXECUTION

3.01 INSTALLATION OF MOTOR STARTER/CONTROLLER
   A. General: Provide motor starter/controller as indicated and where required by the above Code. Comply with switch manufacturers' printed installation instructions.

3.02 FIELD QUALITY CONTROL
   A. Testing: Subsequent to completion of installation of electrical motor starter, energize circuits and demonstrate capability and compliance with requirements. Except as otherwise indicated, do not test switches by operating them under load. However, demonstrate switch operation through six opening/closing cycles with circuit unloaded. Open each switch enclosure for inspection of interior, mechanical and electrical connections, fuse installation, and for verification of type and rating of fuses installed. Correct deficiencies then retest to demonstrate compliance. Remove and replace defective units with new units and retest.

END OF SECTION 262913
SECTION 265100 - LIGHTING FIXTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Division 26 Basic Electrical Materials and Methods Sections apply to work specified in this Section.

1.02 SUMMARY
A. Extent, location, and details of lighting fixture work are indicated on drawings and in schedules.
B. Types of lighting fixtures in this section include the following: L.E.D.
C. Excavation and backfilling for roadway and parking area lighting poles, standards, and foundations are specified in Division 2.
D. Concrete for embedding parking area lighting poles, and for pole and standard foundations and footings is specified in Division 3.

1.03 SUBMITTALS
A. Product Data: Submit manufacturer's product data and installation instructions on each type building lighting fixture and component.
B. Shop Drawings: Submit layout drawings of interior lighting fixtures and their spatial relationship to each other. In addition, submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet. Submit details indicating compatibility with ceiling grid system. All light fixtures required for this project shall be submitted in one single submittal so that all fixtures can be reviewed at one time.
C. Maintenance Data: Submit maintenance data and parts list for each lighting fixture and accessory; including "trouble-shooting" maintenance guide. Include that data, product data, and shop drawings in a maintenance manual; in accordance with general requirements of Division 1.

1.04 QUALITY ASSURANCE
A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of lighting fixtures of sizes, types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects with lighting fixture work similar to that required for this project.
C. Codes and Standards:
   1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Articles 220, 225, 250, 410, 501 and 510 as applicable to installation, and construction of building lighting fixtures.
   2. NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No.'s LE 1 and LE 2 pertaining to lighting equipment.
3. IES Compliance: Comply with IES RP-1 pertaining to office lighting practices and RP-15, regarding selection of illuminance values for interior office lighting and IES RP-8, 19, 20 and PB-15 pertaining to exterior, parking, and roadway lighting practices and fixtures.

4. UL Compliance: Comply with UL standards, including UL 486A and B, pertaining to lighting fixtures. Provide lighting fixtures and components, which are UL-listed and labeled.

5. NFPA Compliance: Comply with applicable requirements of NFPA 78, "Lightning Protection code," pertaining to installation of exterior lighting fixtures.

1.05 DELIVERY, STORAGE AND HANDLING:
A. Deliver lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from construction debris and physical damage.
B. Store lighting fixtures in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity. Lay flat and blocked off ground.
C. Handle lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.06 SEQUENCING AND SCHEDULING:
A. Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of lighting fixtures with other work.
B. Sequence lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

PART 2 - PRODUCTS
2.01 FIXTURES
A. General: Provide lighting fixtures, of sizes, types and ratings indicated in fixture schedule on drawings.
B. Wiring: Provide electrical wiring within fixture suitable for connecting to branch circuit wiring as follows:
   1. NEC Type AF for 120 volt, minimum No. 18 AWG.
   2. NEC Type SF-2 for 277 volt, minimum No. 18 AWG.
C. Lighting Fixture Types:
   1. General: Various fixture types required are indicated in fixture schedule on drawings. Fixtures must comply with minimum requirements as stated herein. Review architectural drawings and specifications to verify ceiling types, modules, and suspension systems appropriate to installation.
PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures. Notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF LIGHTING FIXTURES
A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Provide fixtures and/or fixture outlet boxes with #12 gauge hangers at each corner, and seismic tabs to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by Architect.

C. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surface.

D. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.

E. Fasten fixtures securely to indicated structural supports, including poles/standards; and ensure that fixtures are plumb and level. Provide individually mounted pendant fixtures longer than 2 feet with twin stem hangers. Provide stem hanger with ball aligners and provisions for minimum one-inch vertical adjustment. Mount continuous rows of fixtures with an additional stem hanger greater than number of fixtures in the row.

F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A, and the National Electrical Code.

G. Support surface mounted fixtures greater than 2 feet in length at a point in addition to the outlet box fixtures stud.

3.03 INSTALLATION OF POLES/STANDARDS
A. Install pole and standard units and products as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NESC and NEMA standards, and with recognized industry practices to ensure that parking area lighting equipment fulfill requirements.

B. Utilize belt slings or rope (not chain or cable) to protect finishes when rising and setting finished poles and standards.

C. Set poles and standards plumb. Support adequately during backfilling, or when anchoring them to the foundations.

D. Provide sufficient space encompassing hand access and cable entrance holes for installation of underground cabling where indicated.
3.04 FIELD QUALITY CONTROL  
A. Replace defective and burned out lamps for a period of one year following the Date of Substantial Completion.  
B. At Date of Substantial Completion, replace lighting fixtures, which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Architect.

3.05 ADJUSTING AND CLEANING  
A. Clean lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses and reflectors.  
B. Protect installed fixtures from damage during remainder of construction period.  
C. Aim adjustable lighting fixtures and lamps in night test of system. Verify that measured illuminance values comply with Isolux plot diagram values.

3.06 GROUNDING  
A. Provide equipment grounding connections for lighting fixtures as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

3.07 DEMONSTRATION  
A. Upon completion of installation of lighting fixtures, and after building circuitry has been energized; apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 265100
SECTION 271300 - STRUCTURED CABLING

PART 1 – GENERAL

1.01 Section Includes
   A. Communications horizontal cabling
   B. Communications faceplates and connectors
   C. Communications connecting cords, devices and adapters

1.02 Products Installed but not Supplied Under This Section
   A. All conduit and EMT required for Communications cabling pathway in/out of cross connect closets and in/out of wall cavities at the work area. EMT or Conduit for pathways shall have no more than two 90 degree bends and no continuous section over 100’.
   B. All core holes and poke through devices in the floor for the installation of Communications cabling.
   C. All core holes and EMT sleeves between floors for the routing of Communications cabling.
   D. Backboxes for the mounting of NEMA sized faceplates.
   E. Drag line or pull string at the backboxes fished through EMT or conduit to the other end for installing 4 pair and multi-pair cables.

1.03 Related Sections
   A. General Conditions
   B. Basic Electrical Requirements
   C. Communications Horizontal Cabling

1.04 References
   B. ANSI/TIA/EIA 568-B.2, Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components
   D. ANSI/TIA/EIA 569-B Commercial Building Standards For Telecommunications Pathways And Spaces
   E. ANSI/TIA/EIA 606-A The Administration Standard For The Telecommunications Infrastructure Of Commercial Building
   F. ANSI/J-STD-607-A Commercial Building Grounding And Bonding Requirements For Telecommunications
   G. ANSI/TIA/EIA-606-A, Administration Standard for Commercial Telecommunications Infrastructure
I. ANSI/TIA-942 Telecommunications Infrastructure Standard for Data Centers
M. ISO/IEC 11801 – Information Technology – Generic Cabling for Customer Premise
N. IEEE 802.3 Standard for Information technology -Telecommunications and information exchange between systems - Local and metropolitan area networks – Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications
Q. NECA/BICSI-568-A Standard for Installing Commercial Building Telecommunications Cabling
R. Federal Communications Commission Part 15 and Part 68
S. UL 444 – Standard for Safety of Communications Cable
T. UL 1666 – Standard for Safety of Flame Propagation Height
U. NFPA 262 – Flame Travel and Smoke of Wires and Cables
V. Local Authority Having Jurisdiction

1.05 Definitions

ANSI – American Northern Standards Institute
AWG – American Wire Gauge
BICSI – Building Industry Consulting Service International
EIA – Electronics Industry Alliance
ETL – Intertek Semko Labs
FCC – Federal Communications Commission
IEC – International Electrotechnical Commission
IEEE – Institute of Electrical and Electronic Engineers
IDC – Insulation displacement contact
ISO – International Standards Organization
J-STD – Joint Standard
NECA – National Electrical Contractors Association
NFPA – National Fire Protection Agency
SC – Subscriber Channel
TIA – Telecommunications Industry Association
UL – Underwriters Laboratory
1GBase-T – networking protocol capable of transmitting 1 billion bits of information per second over copper twisted pair
10GBase-SX – networking protocol capable of transmitting 10 billion bits of information per second over optical fiber at 850 nanometers

1.06 Systems Description
A. Horizontal copper cabling system consists of Category 6 cables with four unshielded twisted pairs of solid annealed copper wrapped in plenum rated insulation with an overall plenum rated jacket with a wire thickness of 23 AWG. Each four pair cable is terminated onto 8 position 8 conductor Category 6 connectors using 110 style IDCs. Connectors are placed into NEMA sized faceplates at the work area and placed into rack mounted patching panels in the equipment / networking rooms.

1.07 Submittals
A. Refer to Section 013400 for submittal procedures.
B. Refer to Section 271303 for submittal requirements.

1.08 Quality Assurance
A. Qualifications
1. Install all components as directed by Manufacturer’s installation guidelines.
2. All products shall bear the mark of UL or ETL for performance level.
3. System installation shall meet all applicable Local/State codes and safety requirements where project is located.
4. All products shall be new and un-used in original packaging.
B. Manufacturer Qualifications
1. Manufacturer shall be a telecommunications product manufacturer with at least 25 years experience.
2. Manufacturer shall be ISO 9001 certified manufacturer and shall employ Six Sigma methodology in its manufacturing process.
C. Bidder Qualifications
1. Bidding Contractor shall be a licensed to install telecommunications systems in the state where work will be performed.
2. Bidding Contractor shall have a minimum of 5 years experience installing structured cabling for telecommunications.
3. Bidding Contractor shall have the capability to bond project in its entirety.
4. Bidding Contractor shall be able to provide insurance at the request of the owner.
D. Installer Qualifications
1. Installer shall have an on site supervisor and one technician who are certified by the Manufacturer to install the Manufacturer’s telecommunications products.

2. Communications Contractor shall have an RCDD on staff to certify that the Communications System can support the required applications on the various cabling media.

3. Communications Contractor shall have obtained training from the Manufacturer within 1 year prior to performing the Work.

E. Testing Agency Qualifications

1. Independent testing agencies shall be nationally recognized as having the expertise to independently verify copper and optical fiber cabling systems and components for performance.

F. Delivery, Storage, and Protection

1. Communications Contractor shall ensure that materials delivery to work area shall be coordinated with construction site manager responsible for materials distribution to all trades.

2. Communications Contractor is responsible for all materials, tools and vehicles left on the job site.

3. Communications Contractor shall coordinate a disposal bin for the removal of all trash produced by the Communications Contractor personnel during the project.

4. Communications Contractor shall ensure materials are stored in an environmental area where:
   a. Temperature does not exceed 120 degrees Fahrenheit nor below 32 degrees Fahrenheit.
   b. Humidity does not exceed 80 %.
   c. No direct exposure to sunlight.

5. Follow Manufacturer’s recommendations for handling of materials.

1.10 Project Conditions

A. Environmental Requirements

1. Communications Contractor shall ensure that any pollutants produced during the Work is disposed off according to local, state or national regulations. Follow the most stringent guidelines.

2. It is preferred that the Communications Contractor recycle any used or un-used components during the course of the construction project.

B. Field Measurements

1. Communications Contractor shall coordinate with electrical engineer on project that the main electrical service ground has a resistance to earth of less than 5 ohms.

2. Communications Contractor shall ensure that all grounding busbars for all equipment /network rooms shall have a resistance of less than 1 ohm back to the main electrical service ground.

3. Communications Contractor shall ensure that all field testers have been calibrated from the Manufacturer within 1 year.
1.11 Sequencing
   A. Communications Contractor shall coordinate with Owner’s project manager on sequencing of
      various trades and construction teams for the lifecycle of the project.

1.12 Scheduling
   A. Communications Contractor shall provide a detailed construction schedule with hard dates for
      completion of roughing in cables, terminations and testing once scheduling sequence has
      been determined to the Owner’s Project Manager.
   B. Cabling schedule shall be in a software program designated by the Owner’s Project Manager.

1.13 Warranty
   A. Communications Contractor shall provide a 1 year parts and labor warranty against defective
      workmanship and/or system component failure.
   B. Communications Contractor shall execute a Lifetime Applications Assurance Warranty for
      parts and labor to support stated applications from the connectivity Manufacturer.

PART 2 – PRODUCTS

2.01 Manufacturers
   A. Copper Cable System and Fiber Optic Systems:
      1. SuperiorEssex
      2. General Cable
      3. Mohawk
   B. Connectors:
      1. Leviton
      2. Panduit
      3. Hubbell

2.02 System Performance
   A. Horizontal four pair Category 6 copper cabling system shall be capable of supporting
      1GBase-T applications for a total distance of 100 meters with equipment cords.

2.03 Source Quality Control
   A. Materials shall be purchased from Distributors authorized by system Manufacturers to sell
      new and unused components.

PART 3 – EXECUTION

3.01 Installation
   A. Follow and adhere to installation practices specified by the applicable Telecommunications
      Industry Association standards.
   B. Follow and adhere to installation practices specified by BICSI Information Transport System
   C. Follow and adhere to installation practices specified by BICSI Telecommunications
E. Follow and adhere to installation practices specified by the Manufacturers.

3.02 Field Quality Control
A. Contractor shall make available all ceiling and termination work for inspection by Manufacturer’s representative or owner’s representative.
B. Contractor shall replace all defective components.

3.03 Adjusting
A. No additional work outside of the contract scope of work shall be completed without the approval of the Owner or Owner’s representative.

3.04 Cleaning
A. Communications Contractor shall wipe down all equipment racks, cabinets and panels prior to turnover to the Owner.
B. Communications Contractor shall sweep and mop the floors of all equipment rooms or connection point closets prior to turnover to the Owner.

3.05 Protection
A. It is the responsibility of the Communications Contractor to ensure equipment is protected from dust and water during the project with appropriate materials.
B. Remove all protective covers and protective materials from equipment prior to turnover to Owner.

3.06 Schedules
A. Coordinate communications work with Owner’s project manager and follow scheduling sequence as established by Owner’s project manager.
B. It is recommended that the Communications Contractor schedule closely with any systems furniture contractor to ensure turnover date is met.

END OF SECTION 271300
SECTION 271303 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 – GENERAL

1.01 Section Includes
A. Communications system requirements for unshielded horizontal twisted four pair Category 6 copper cabling
B. Category 6 unshielded twisted four pair cable

1.02 Related Sections
A. Procurement and Contracting requirements
B. General Requirements
C. Structured Cabling
D. Communications Equipment Room Fittings
E. Communications Backbone Cabling

1.03 References
A. ANSI/TIA/EIA-568-B.1 – Addendum 1-2001, Commercial Building Telecommunications Cabling Standard, Part 1: Minimum 4-Pair UTP and 4-Pair ScTP Patch Cable Bend Radius
F. ANSI/TIA/EIA-568-B.2 – Addendum 4-2002, Commercial Building Telecommunications Cabling Standard, Part 2: Solderless Connection Reliability Requirements for Copper
   1. Connecting Hardware
I. ANSI/TIA/EIA-568-B.2 – Addendum 7-Pending, Commercial Building Telecommunications Cabling Standard, Part 2: Reliability Specifications for Copper Connecting Hardware
K. ANSI/TIA/EIA 568-B.2 – Addendum 10-Draft 7.0, Commercial Building Telecommunications Cabling Standard, Part 2: Transmission Performance Specifications for 4-pair 100 OHM Category 6 Balance Requirements


1.04 Definitions

A. ACR-F – Attenuation to Crosstalk Ratio Far End is the ratio of the attenuated signal on one pair to the crosstalk on an adjacent pair at the far end. Also known as ELFEXT.

B. Baseband – single un-multiplexed signaling

C. CAD – Computer Assisted Design

D. IL – Insertion Loss is a decrease in transmitted power

E. Level III or Level IV – Tester accuracy established by UL

F. LCL – Longitudinal Conversion Loss

G. MHz – Megahertz

H. NEXT – Near End Crosstalk is noise induced from one pair to another pair within the cable jacket

I. Ohm – Measure of electrical resistance or impedance

J. PowerSum ACR-F – the ratio of the attenuated signal on multiple pairs to the crosstalk on a victim pair at the far end. Also known as PSELFEXT.

K. PowerSum NEXT – noise induced from multiple pairs to a single pair within the cable jacket

L. RL – Return Loss is the ratio, expressed in decibels, of the power of the outgoing signal to the power of the signal reflected back

M. TDR – Time Domain Reflectometer

1.05 System Description

A. Copper cabling system use a 4 pair unshielded twisted pair cable that is capable of transporting and supporting network speeds up to 1 Gigabit per second.

B. Copper cabling system is capable of supporting baseband signaling for voice, data or video applications.

C. Cabling system is a modular system utilizing an 8 position 8 conductor jack and plug for termination and interface.

D. Cabling system components are expected to provide more than 25 years of continuous operation.

E. Cabling system is a NextLAN solution from Leviton and SuperiorEssex.
1.06 Submittals

A. With bid

   Product Data: Provide component descriptions and describe electrical characteristics of components.

B. Prior to installation

   1. Show pathway, footages and labeling sequence of all cables and faceplate locations on As-Built drawing in CAD prior to starting the Work for approval by Owner.
   2. Provide a hard copy and soft copy of proposed test results to be submitted in the Level III or Level IV TDR tester’s native format for verification of electrical performance.
   3. Provide the most current UL or ETL test results showing Category 6 compliance for the proposed cabling system.

C. Prior to final acceptance

   1. Provide a 3’ by 3’ hard copy and soft CAD copy As-Built of the floor plan showing pathway, footages and labeling sequence of all cables and faceplates upon Substantial Completion.
   2. Provide 1 copy of printed and 1 soft copy of all Category 6 cable test results in the Level III or Level IV tester’s native format.
   3. Provide a warranty statement from the cable Manufacturer that the project has a Lifetime warranty against defects in features and performance of products.
   4. Ensure warranty specifies that the Owner is entitled to all rights guaranteed by the warranty.

D. Warranty

   1. Communications Contractor shall provide a 1 year parts and labor warranty against defective workmanship and cable system component failure.
   2. Communications Contractor shall execute a Lifetime warranty against materials defect and an Applications Assurance Warranty for 1GBase-T applications for parts and labor from the cable system Manufacturer.

PART 2 – PRODUCTS

2.01 Manufacturers

A. Category 6 connectors:

   1. Leviton
   2. Panduit
   3. Hubbell

B. Category 6 cable:

   1. Superior Essex
   2. General Cable
2.02 Performance and Features

A. Attributes

1. Cable system shall have an Impedance value of 100 ohms.
2. All Category 6 cable conductors shall be terminated onto 8 position 8 conductor Category 6 connectors using 110 style IDC.
3. All Category 6 connectors shall be placed into QuickPort faceplates.
4. Cable system shall have Category 6 blue cables installed at every faceplate for data jacks.
5. Cable system shall have Category 6 white cable for voice jacks.
6. Appearance of cable system faceplates shall match the décor and mounting height of electrical outlet faceplates.
7. All faceplates shall have a station identification window for a machine label protected behind transparent plastic.

B. Requirements

1. Copper cabling system shall be guaranteed to support baseband signaling from 1 MHz up to 250 MHz.
2. Horizontal copper cabling system shall be capable of supporting 1GBase-T applications for a total distance of 100 meters with equipment cords for the life of the system.
3. Cable system shall be guaranteed to not introduce bit errors when operating at 1 Gigabit/second for the Life of the system.
4. Cable system shall have a Lifetime warranty for 1GBase-T applications assurance.
5. Cable system patch cords shall be rated for 1GBase-T applications.

C. Criteria

0. Cabling System shall be capable of exhibiting the following minimum electrical characteristics when tested as a 4 connector Channel, using a Level III or Level IV tester:

   a. Insertion Loss (IL) / 33 dB
   b. Near End Crosstalk (NEXT) / 38 dB
   c. PowerSum NEXT (PSNEXT) / 37 dB
   d. Attenuation Crosstalk Ratio – (ACR) / 7 dB
   e. PowerSum ACR (PSACR) / 6 dB
   f. Attenuation Crosstalk Ratio Far End – (ACR-F) / 20 dB
   g. Power Sum Attenuation Crosstalk Ratio Far End – (PSACR-F) / 18 dB
   h. Return Loss (RL) / 12 dB

D. Tests

1. Test results for all Category 6 copper cables shall be provided on CD in a Level III or Level IV tester’s native format.
2. All Permanent Link tests shall have a “PASS” result for all required parameters from the frequency of 1 to 250 MHZ.
3. One hard copy and one soft copy in the tester’s native format of all test results shall be provided to the Owner upon substantial completion.
4. Test results showing an asterisk (*) will not be accepted as it is below the acceptable margin of the tester’s accuracy limits.

5. All test results shall show electrical performance of the cabling system from 1 – 250 MHz when testing for Insertion Loss, Near End Crosstalk, Power Sum Near End Crosstalk, Attenuation to Crosstalk Ratio Far End, Power Sum Attenuation to Crosstalk Ratio Far End and Return Loss.

2.03 Components

A. Attributes

1. All connectivity and cable shall have a Category 6 designation permanently and visibly displayed on the component.

2. Copper cable shall have a flame retardant and low smoke Polyvinyl Chloride jacket.

3. Copper cable shall have a maximum nominal outer diameter of .24” with a completely round dimension.

4. Category 6 connectors shall provide Pair Separation Towers to assist with pair separation.

5. Category 6 connectors shall provide Retention Force Technology to maintain tine integrity against 4 or 6 position plugs.

B. Requirements

1. Copper cable shall be Superior Essex part # 54-246-2B NextGain Category 6 cable or equal from manufacturer listed in Section 2.01.

2. Connector shall be Leviton part # 61110-RL6 eXtreme 6 connector.

3. Patch panel shall be Leviton part # 69586-U48 Category 6 patch panel with mounting holes and screws or equal from manufacturer listed in Section 2.01.

4. Patch cords shall be Leviton part # 62460-xxL Category 6 equipment cords where “xx” shall be footage required or equal from manufacturer listed in Section 2.01.

5. Faceplate shall be Leviton part # 42080-4WS with top and bottom designation windows to hold a machine label or equal from manufacturer listed in Section 2.01.

6. Copper cable conductors shall be constructed of 23 AWG solid annealed bare high quality copper inside insulation comprising of Flourinated Ethylene Propylene (FEP).

7. Copper cable shall contain eight conductors and twisted into four pairs consisting of a blue/blue-white, orange/orange-white, green/green-white and brown/brown-white configuration.

8. Copper cable shall have a web separator between all pairs.

9. Category 6 connector shall be made of high impact and fire retardant plastic with a UL 94V-O rating.

10. Category 6 connectors and patch panel ports shall have a minimum of 50 micro inches of gold, plated over 100 micro inches of nickel and plated over high quality copper alloy on each and every tine.

11. Category 6 connectors and patch panel ports shall have a minimum force of 100 grams pressure on all the tines for the life of the component.

12. Category 6 connectors and patch panel ports shall use 110 type Insulation Displacement Contacts for the termination of copper cable conductors.
C. Tests
   1. Testing to be performed by contractor.
   2. Field testing of installed cable channel shall be performed by Contractor using Annex I of the TIA/EIA 568-B document.
   3. Testing of connecting hardware components shall be performed using Annex E within the TIA/EIA-568-B.2 Addendum 1 document. Manufacturer of connectors to provide this data.
   4. Testing of four pair cable component shall be performed using Annex C within the TIA/EIA-568-B.2 Addendum 1 document. Manufacturer of cable to provide this data.
   5. Test 100% of station wire in both directions.

PART 3 – EXECUTION

3.01 Examination
   A. Verify that pathways and spaces will allow horizontal cables to be installed according to manufacturer’s recommendations.
   B. Verify that minimum bend radius of 4X the cable diameter can be achieved in pathways and spaces.
   C. Verify that cables can be properly supported by cable tray or hooks in ceiling.
   D. Compare to Contract Drawings and provide written notification if site conditions deviate from drawings.

3.02 Installation
   A. Install all components in a neat and workmanlike manner.
   B. Install all horizontal cables and termination frames in accordance with manufacturer’s recommendations.
   C. Ensure terminations are at 180 degrees to the jack with no more than ¼” un-twisting and no more than ½” un-jacketing.
   D. Ensure terminations have no un-twisting and that tower separators are utilized to separate pairs.
   E. Ensure pulling tensions of cables are not exceeded.
   F. Maintain proper cable bend radius of 4 times the cable’s outer diameter during placement.
   G. No splices are permitted.
   H. No link shall exceed 90 meters. Contractor is responsible for verifying proper footages.
   I. Contractor shall provide in a quick and timely fashion any additional materials or labor that may be damaged during the work at no charge to the owner.
   J. Pull one additional “Mule Tape” or ¼” Nylon rope when pulling cables through any conduit utilizing existing pull string.
   K. Properly support horizontal cables in ceiling every 4’-5’ using J-Hooks or cable tray.
   L. Place horizontal cables in pathways and spaces dedicated for communications cables.
   M. Provide 5’ of slack at station end in ceiling and not inside wall.
N. Machine label all horizontal cables with cable number at both ends.
O. Machine label all termination panels with cable number.
P. Firestop all sleeves and conduit openings after cable installation.
Q. Terminate all pairs and conductors at all ends according to manufacturer’s instructions following color code sequence.
R. Utilize Velcro in all closets.
S. Label and document the horizontal cable installation to include labeling and pathways on the As-Built drawings.

END OF SECTION 271303
SECTION 283111 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Requirements of the following Division 26 Sections apply to this section:
   1. “Basic Electrical Requirements.”
   2. “Basic Electrical Materials and Methods.”

C. The complete installation is to conform to the applicable sections of NFPA-72, NFPA-71, Local Code requirements and National Electrical Code with particular attention to Article 760.

D. The entire installed system and all integrated system operations shall be within the guidelines of the IBC Indiana Uniform Building Code, Indiana Uniform Fire Code and the Indiana Uniform Mechanical Code.

E. NFPA 90A


G. ADA

H. ASME/ANSI A17.1 and A17.3.

1.02 SUMMARY

A. Work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations required for relocation of the Fire Alarm System as shown on the drawings and as herein specified, and as directed by the Architect/Engineer.

B. The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.

1.03 SYSTEM DESCRIPTION

A. General: Complete, zoned fire detection and alarm system with manual and automatic alarm initiation, initiating devices, and automatic alert for certain smoke sensor zones as indicated.

1.04 SUBMITTALS

A. Product data for system components. Include dimensioned plans and elevations showing minimum clearances and installed features and devices.

B. Wiring diagrams from manufacturer differentiating between factory- and field- installed wiring.

C. Product Certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.

D. Record of field tests of system.
1.05 QUALITY ASSURANCE

A. Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriter's Laboratories, Inc. (UL), and shall bear the "U.L." label.

All control equipment is to be listed under UL category UOJZ as a single control unit. Partial listings shall NOT be acceptable.

B. All control equipment must have transient protection devices to comply with UL864 requirements.

I. Where Fire Alarm circuits leave the building, additional transient protection must be provided for each circuit. Devices must be UL listed under standard #497B (Isolated Loop Circuit Protectors).

1.06 EXTRA MATERIALS

A. General: Furnish extra materials, matching products installed (as described below), packaging with protective covering for storage, and identifying with labels clearly describing contents.

B. Lamps for Strobe Units: Furnish four (4) lamps.

C. Smoke Detectors, Fire Detectors, and Flame Detectors: Furnish one (1) of each type installed.

D. Detector Bases: Furnish one (1) of each type installed.

E. Provide completely installed horn/strobe unit as directed by Engineer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Existing FireLite MS 4424B

B. The Manufacturer shall be nationally recognized company specializing in smoke detection and fire alarm systems. This organization shall employ factory trained and NICET certified technicians, and shall maintain a service organization within 75 miles of this project location. The Manufacturer and service organization shall have a minimum of 10 years experience in the fire protective signaling systems industry.

2.02 MANUAL PULL STATIONS

A. Description: Single-action type, fabricated of high impact red polycarbonate or metal, and finished in red with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the FACU.

1. Protective Shield: Provide a tamperproof, clear polycarbonate shield and red frame that easily fit over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. Lowering and realigning the shield shall silence the horn. The horn shall provide 85 dB at 10 feet and shall be powered by a 9 VDC battery.
2.03 SMOKE SENSORS AND BASES

A. General: Comply with UL 268, “Smoke Detectors for Fire Protective Signaling Systems.” Include the following features:

1. Modular Arrangement: Sensor and associated encapsulated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. The detector head shall have a locking feature that shall be field removable when not required.

2. Quick Connect Arrangement: The single piece unit shall twist-lock onto a supplied mounting bracket that attaches to a standard electrical box.

3. Each sensor shall contain an LED that will flash each time it is scanned by the FACU and glows steady in an alarm or a trouble condition.

4. Each sensor shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.

B. Modular Photoelectric Smoke Sensors. Include the following features and characteristics:

1. An infrared sensor light with matching photosensitive receiver actuated by the presence of visible products of combustion.

2. The photo sensor sensitivity range shall be programmable from 0.2% to 3.7% smoke obscuration for applications from clean rooms to mechanical equipment rooms.

C. Modular bases: Each modular base shall accept either a photoelectric, ionization, or heat sensor.


2. Remote LED Base: Shall include provisions for connection of a remote LED alarm indicator.

3. Relay Base: Shall include provisions for connection of a remote relay and remote LED alarm indicator.

D. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Duct Sensor includes relay as required for fan shutdown.

1. The Duct Housing shall provide an auxiliary alarm relay with a single “Form C” contact rated at 1 A @ 28 VDC resistive. This auxiliary relay operates when the sensor reaches its alarm threshold, or when the FACU via software control, manually or automatically operates the relay in response to inputs from other devices.

2. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.

3. The duct sensor sensitivity range shall be programmable from 0.5% to 3.7% smoke obscuration.

4. Duct Detector to alarm in supervisory mode only.

2.04 ALARM NOTIFICATION APPLIANCES

A. Fire Alarm Audible/Visual Appliances: Horns shall be electronic polarized type operating with a piezoelectric element. Horns produce a sound pressure level of 87dB, measured 10
feet from the source. Strobes shall be adjustable candela xenon flash output, 24 VDC operation, wall mounted, compatible with ADA requirements.

B. Visual Notification Appliances: adjustable candela xenon flash output, 24 VDC operation, wall mounted, compatible with ADA requirements with the word “FIRE” clearly visible.

2.05 FOUR CHANNEL DIGITAL COMMUNICATOR
A. Provide a device to notify the fire department via local telephone lines for future use. Also provide interface to burglar alarm for notifying monitoring service.

2.06 EMERGENCY POWER SUPPLY
A. General: Components include battery, charger, and an automatic transfer switch.
B. Battery: Sealed lead-acid type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours and notification appliances in alarm or supervisory mode for a period of 5 minutes.

2.07 WIRE
A. Line Voltage and Low Voltage Circuits: Solid copper conductors with 600 V rated insulation or as recommended by manufacturer.

2.08 TAGS
A. Tags for Identifying Tested Components: Comply with NFPA 72.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL
A. Install the system according to NFPA Standards reference in Parts 1 and 2 of this Section.
B. Fire Alarm Power Supply Disconnect: Shall be painted red and labeled “FIRE ALARM.” Provide with a lockable handle or cover.

3.02 EQUIPMENT INSTALLATION
A. Manual Pull Stations: Mount semi-flush in recessed back boxes 48” to top (side reach) above finished floor or as indicated.
B. Smoke Detectors: Install ceiling-mounted detectors not less than 4 inches from a sidewall to the near edge. Install detectors located on the wall at least 4 inches but not more than 12 inches below the ceiling. For exposed solid joist construction, mount detectors on the bottoms of the joists. On smooth ceilings, install detectors not over 30 feet apart in any direction. Install detectors no closer than 5 feet from air registers.
C. Notification Appliances: Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille or as indicated. Combine audible and visual notification appliances at the same location into a single unit.
D. Fire Alarm Control Unit (FACU): Surface mount with tops of cabinets not more than 6 feet above the finished floor.

3.03 WIRING INSTALLATION
A. Wiring Method: Install wiring in metal raceway where exposed. Conceal wiring except in unfinished spaces and as indicated.
B. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of the National Electric Code (NEC). It is the Contractor’s responsibility to obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. The Contractor shall make no deviation from the written instruction without the prior written approval of the Fire Alarm System Manufacturer.

C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notifications appliance circuits. Paint fire alarm system junction boxes and covers red.

D. Fan Shutdown: Air handling equipment shall be connected to relays in its respective duct smoke detector.

3.04 GROUNDING
A. Ground equipment and conductor and cable shields as specified by the equipment manufacturer. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

3.05 FIELD QUALITY CONTROL
A. Manufacturer’s Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

B. Pretesting: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

C. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

D. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.

E. Final Test, Certificate of Completion, and Certificate of Occupancy:
   1. Test the system as required by the Authority having Jurisdiction in order to obtain a certificate of occupancy. Demonstrate that the system meets the Specifications and complies with applicable standards. This final test shall be witnessed by a representative of the Authority having Jurisdiction and a factory-authorized service representative.

3.06 CLEANING AND ADJUSTING
A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.
B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.07 TRAINING
A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner’s maintenance personnel as specified below.

1. Train Owner’s maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 2 hours training.

2. Schedule training with the Owner at least seven days in advance.

END OF SECTION 283111
SECTION 31 31 16 – TERMITE CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Termite treatment of new structure.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry."
   2. Division 06 Section "Sheathing."

1.03 SUBMITTALS

A. Product Data: For each type of termite control product indicated. Include EPA-Registered Label for termite products.

B. Qualification Data: For licensed and manufacturer accredited installer.

C. Test Reports: Provide 5-year product specific efficacy studies, concrete application studies and application history.

D. Product Certificates.

E. Termite Treatment Report. Include the following:
   1. Date and time of application
   2. Quantity of undiluted termite used.
   3. Dilutions, methods, volumes used and rates of application.
   4. Areas of application.
   5. Areas not accessible.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located and who employs workers trained and approved by manufacturer to install manufacturer's products.

B. Regulatory Requirements: Formulate and apply termiteicides and termite devices according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products from single source from single manufacturer.

D. Pre-installation Conference: Conduct conference at Project site.
1.05 PROJECT CONDITIONS
   A. Coordinate application of termiticide treatment of structure with access to all structural framing members and foundations. Install termiticide during the dried-in phase after all structural framing and sheathing is in place and prior to installation of drywall, insulation, mechanical systems and electrical wiring.

1.06 WARRANTY
   A. Special Warranty: Standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied termiticide treatment and physical barriers, will prevent infestation of subterranean and Formosan termites. Installer agrees to re-treat structure with termiticide treatments and/or repair or replace damage where subterranean and Formosan termite activity is discovered during warranty period as directed by warranty.

   B. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURER
   A. Nisus Corporation; 100 Nisus Drive; Rockford, TN 37853; Phone.
   B. Equal approved by addendum or in writing by architect.

2.02 TREATMENT
   A. Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

      1. Basis-of-Design: Subject to compliance with requirements, provide Nisus Corporation; BORA-CARE® Commercial Termiticide, Insecticide and Fungicide [or approved equal].
         a. Active Ingredient: 40% Disodium Octaborate Tetrahydrate (DOT)
         b. Penetrant: Patented Glycol mixture.

   B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.

   C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

PART 3 - EXECUTION

3.01 GENERAL
   A. Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

   B. Metal Protection: Where stainless steel mesh will contact dissimilar metals, protect against corrosion by applying contact surfaces with corrosion resistant materials as recommended by manufacturer for this purpose.
3.02 TERMITE TREATMENT TO STRUCTURE APPLICATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for interfaces with slab and foundation work, utility installation and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

C. Termiticide Treatment Preparation: Remove foreign matter and impermeable materials that could decrease treatment effectiveness on areas to be treated.

D. Application: Mix termiticide treatment solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label. Apply to the following areas so that a continuous horizontal and vertical termiticide barrier or treated zone is established at the foundation building construction. Distribute treatment evenly.

1. Structural Components and Sill Plates: Treat all structural concrete, block, steel & wood and sill plates up 24 inches from contact with foundation as required by label.

2. Sheathing: Treat all cellulosic sheathing up 24 inches from the foundation.

3. Concrete Slab: Treat concrete slab a minimum of 2 – 8 inches out from all sill plates.

4. Bath Traps: Treat open bath traps and surrounding 12 inches of slab area.

5. Penetrations: Treat all pipe and plumbing penetrations to a height of 24 inches and a minimum of 6 inches surrounding penetration.

6. Crawl space Foundation Walls: Treat inside surface of crawl space concrete or concrete block walls extending up vertically 24 inches from soil.

7. Crawl space/Basement Flooring: Treat all sill plates, box headers and joist 24 inches out from contact with foundation walls or piers.

8. Basement: Treat inside surface of basement concrete or concrete block walls extending up vertically 24 inches from slab.

9. Expansion Joint and Abutting Connections: Treat abutting slab areas and expansion joints a minimum of 6 inches out on each side of joint or abutting slab connection.

END OF SECTION 31 31 16