

PROJECT MANUAL

SPECIFICATION DIVISION 00-14

TRITON CENTRAL HIGH SCHOOL RENOVATIONS

PREPARED FOR:

**NORTHWESTERN CONSOLIDATED SCHOOL
DISTRICT OF SHELBY COUNTY**

DATE: April 20, 2023



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NOT USED

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NOT USED

END OF INDEX

LETTER OF INSTRUCTIONS

PROJECT NAME: TRITON CENTRAL HIGH SCHOOL RENOVATIONS

**ALL REQUESTS FOR INFORMATION DURING THE
BIDDING PROCESS SHALL BE SUBMITTED IN
WRITING BY EMAIL TO:
rpitman@lancerarchitects.com**

Ralph Pitman is also available at phone number 317-748-0670.

END OF LETTER OF INSTRUCTIONS

NOTICE is hereby given that sealed bids will be received as follows:

BY: NORTHWESTERN CONSOLIDATED SCHOOL DISTRICT
4920 W. 600 N.
Fairland, IN 46126

FOR: TRITON CENTRAL HIGH SCHOOL RENOVATION

Bids will be opened and publicly read aloud at:

TRITON CENTRAL HIGH SCHOOL
4774 W. 600 N.
Fairland, IN 46126

At the following day and time: Tuesday, May 16, 2023 at 2:00 PM local time.

Bids may be delivered to the following location until the time as indicated:

TRITON CENTRAL HIGH SCHOOL
4774 W. 600 N.
Fairland, IN 46126

Bids received after the date and time set for receipt and opening of bids as herein indicated will be returned unopened.

Bids will be received for a single prime contract.

Bids shall be in full accordance with the Construction Documents which are now on file with the Owner or with the Architect and may be examined by prospective Bidders at the following locations:

Dodge Data & Analytics
Website: www.construction.com
Email: support@construction.com
Phone: 800-393-6343

Construct Connect
3825 Edwards Rd., Suite 800
Cincinnati, OH 45209
Phone: 800-364-2059
Website: www.constructconnect.com

BX Indiana
1028 Shelby Street
Indianapolis, IN 46203
Phone: 317-423-7080
Fax: 317-423-7094
projects@buildingex.com

BidTool
Construction Data Company Inc.
4201 W. Parmer Lane, Ste A200
Austin, TX 78727
Phone: 888-506-7613
plans@bidtool.net

ISQFT – Construction Software Technology
The Rockwood Exchange
3825 Edwards Rd, Suite 800
Cincinnati, Ohio 45209
Phone: 800-364-2059

Bidders may obtain complete sets of Construction Documents from Reprographix, 437 N. Illinois Street, Indianapolis, IN 46204, Phone: 317-637-3377; www.reprographix.com , for no charge to bidder.

Digital Files (PDFs) of the drawings and specs are available for no charge to bidder.

Bids shall include BID SECURITY in the form of a Bid Bond or certified check in the amount of a sum no less than 5 percent of the Bid Sum including all add alternates.

The Owner reserves the right to accept or reject any or all bids and to waive any irregularities in bidding. Base bids may be held for the following period before award of Contract: Ninety (90) Days.

Should a successful Bidder withdraw his bid or fail to satisfactorily execute all of the requirements and enter into a written Contract within ten (10) days after Notice of Acceptance of his bid, the Owner may declare the Bid Security forfeited, not as a penalty, but as liquidated damages.

END OF NOTICE TO BIDDERS

DOCUMENT 00 2113 - INSTRUCTIONS TO BIDDERS

1.1 INTENT

- A. The intent of this Bid request is to obtain an offer for each project to perform work to complete the project for a Stipulated Sum contract, in accordance with Contract Documents.

1.2 CONTRACT TIME

- A. Start construction on May 30, 2023 and be Substantially Complete by August 2, 2023.

1.3 DEFINITIONS

- A. Bidding Documents: Contract Documents supplemented with Notice to Bidders, Instructions to Bidders, Bid Form, Bid Form Supplements and Appendices, and bid securities, identified.
- B. Bid: Executed Bid Form and required attachments submitted in accordance with these Instructions to Bidders.
- C. Bid Sum: Monetary sum identified by the Bidder in the Bid Form.

1.4 CONTRACT DOCUMENTS IDENTIFICATION

- A. The Contract Documents are identified as Project number 23106 as prepared by LANCER ASSOCIATES located at 427 South College Avenue, Suite 103, Indianapolis, Indiana 46203.

1.5 AVAILABILITY OF DOCUMENTS

- A. Bidding Documents may be obtained as stated in Notice to Bidders.
- B. Bidding Documents are made available only for the purpose of obtaining offers for this Project. Their use does not grant a license for other purposes.

1.6 INQUIRIES AND ADDENDA

- A. Direct questions in writing by email to rpitman@lancerarchitects.com
- B. Verbal answers are not binding on any party.
- C. Submit questions not less than 7 days before date set for receipt of Bids. Replies will be made by Addenda.
- D. Addenda may be issued during bidding period. Addenda will be sent to known Bidders. Addenda become part of the Contract Documents. Include resultant costs in the Bid Sum.

1.7 PRODUCT SUBSTITUTIONS

- A. Where Bidding Documents stipulate particular Products, substitution requests will be considered by Architect/Engineer up to 10 days before receipt of Bids.
- B. With each substitution request, provide sufficient information for Architect to determine acceptability of proposed products.
- C. When a request to substitute a Product is made, Architect may approve the substitution. Approved substitutions will be identified by Addenda.
- D. In submission of substitutions to Products specified, Bidders shall include in their Bid, changes required in the Work and changes to Contract Time and Contract Sum to accommodate such approved substitutions. Later claims by the Bidder for an addition to the Contract Time or Contract Sum because of changes in Work necessitated by use of substitutions will not be considered.
- E. A request constitutes a representation that Bidder:
 - 1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
 - 2. Will provide same warranty for Substitution as for specified product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 - 5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.
 - 6. The product shall be readily available in sufficient quantity to prevent delay of any work, available in the same range of colors, textures, dimensions, gages, types, and finishes as the material specified.
 - 7. The product shall be equal in strength, durability, efficiency, serviceability, ease and cost of maintenance and compatible with the building design and not necessitate design modifications by the Architect/Engineer nor impose additional work or require changes in the work.

1.8 SITE EXAMINATION

- A. Examine Project site before submitting a Bid.
- B. Contact the Owner to arrange date and time to visit Project site:
- C. No claims for extra compensation shall be allowed due to failure of any Bidder to examine conditions which exist at the building site nor for conditions of difficulties encountered in execution of work which may have been avoided by such examination.

1.9 SUBCONTRACTORS

- A. The Owner reserves the right to reject a proposed Subcontractor for reasonable cause.

- B. Refer to AIA Document A201-2007, Article 5 of General Conditions.

1.10 SUBMISSION PROCEDURE

- A. Bidders shall be solely responsible for delivery of Bids in manner and time prescribed.
- B. Submit two copies of executed offer on Bid Forms provided, signed and sealed with required security deposit in a closed opaque envelope, clearly identified with Bidder's name, Project name, and Owner's name on the outside.
- C. The following items must be included with the Bid:
 - 1. Bid Security.
 - 2. Form No. 96 (Revised 2013) Contractor's Bid for Public Work
 - 3. Document 00 41 13 Bid Form – Stipulated Price
 - 4. Written drug testing plan that covers all employees of the bidder who will perform work on the public works project and meets or exceeds the requirements of IC 4-13-18-5 or IC 4-13-18-6.
- D. An abstract summary of submitted Bids will be made available to all Bidders following bid opening.

1.11 BID INELIGIBILITY

- A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, may be declared unacceptable at Owner's discretion.
- B. Bid Forms, Appendices, and enclosures which are improperly prepared may be declared unacceptable at Owner's discretion.
- C. Failure to provide security deposit, bonds or insurance requirements may invalidate the Bid at the discretion of the Owner.

1.12 SECURITY DEPOSIT

- A. Bids shall be accompanied by security deposit as follows:
 - 1. Bid Bond or certified check in the amount of a sum no less than 5 percent of the Bid Sum plus all add alternates on AIA Document A310 - Bid Bond.
- B. Endorse Bid Bond or certified check in name of the Owner as obligee, signed and sealed by the principal (Contractor) and surety.
- C. Security deposit of accepted Bidder will be returned after delivery to the Owner of the required Performance and Payment Bonds by the accepted Bidder.
- D. Include the cost of security deposit in the Bid Sum.
- E. After a Bid has been accepted, security deposits will be returned to the respective Bidders.
- F. If no contract is awarded, security deposits will be returned.

1.13 BID FORM REQUIREMENTS

- A. Complete requested information in the Bid Forms.

1.14 TAX EXEMPTION

- A. Materials supplied for this project are exempt from Indiana State sales tax.

1.15 BID FORM SIGNATURE

- A. Sign Bid Form, as follows:
 - 1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature. [Affix seal.]
 - 2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature. [Affix seal to each signature.]
 - 3. Corporation: Signature of a duly authorized signing officers in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal. If the Bid is signed by officials other than the president and secretary of the company, or the president/secretary/treasurer of the company, submit a copy of the by-law resolution of their board of directors authorizing them to do so, with the Bid Form in the bid envelope.
 - 4. Joint Venture: Signature of each party of the joint venture under their respective seals in a manner appropriate to such party as described above, similar to requirements for Partnerships.

1.16 DURATION OF OFFER

- A. Bids shall remain open to acceptance and shall be irrevocable for a period of 30 days after bid closing date.

1.17 ACCEPTANCE OF OFFER

- A. The Owner reserves the right to accept or reject any or all offers.
- B. After acceptance by the Owner, the Architect on behalf of the Owner, will issue to the accepted Bidder, a written Letter of Intent.
- C. Notwithstanding delay in the preparation and execution of the Agreement, accepted Bidder shall be prepared, upon written Notice to Proceed, to commence work within seven days following receipt of official written order of the Owner to proceed, or on date stipulated in such order.
- D. The accepted bidder shall assist and cooperate with the Owner to prepare the Agreement, and within 7 days following its presentation shall execute Agreement and return it to the Owner.

END OF SECTION 00 2113

INSTRUCTIONS TO BIDDERS

00 2113 - 4



CONTRACTOR'S BID FOR PUBLIC WORK - FORM 96

State Form 52414 (R2 / 2-13) / Form 96 (Revised 2013)
Prescribed by State Board of Accounts

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/ZIPcode: _____

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. 5-16-8-2). 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?

Contract Amount	Class of Work	Completion Date	Name and Address of Owner

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

Contract Amount	Class of Work	Expected Completion Date	Name and Address of Owner

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 _____) ss

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 _____

DOCUMENT 00 4113 - BID FORM - STIPULATED PRICE

To: NORTHWESTERN CONSOLIDATED SCHOOL DISTRICT

Project: TRITON CENTRAL HIGH SCHOOL RENOVATIONS

Date:

Submitted by:
(full name)

(full address)

.....

(phone number).....

1. OFFER

Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by LANCER ASSOCIATES for the above mentioned project, we, the undersigned, having become thoroughly familiar with the terms and conditions of the proposed Contract Documents and with local conditions affecting the performance and costs of the work at the place where the Work is to be completed, and having fully inspected the site in all particulars, hereby offer to enter into a Contract to perform the Work for the Sum of:

BASE BID:

.....

.....\$......dollars, in lawful
money of the United States of America.

ALTERNATES:

Alternate No. 1: **(Add finish work in bathroom)**

LUMP SUM ADD.....\$......dollars

We have included, the security deposit or Bid Bond as required by the Instruction to Bidders.

All applicable taxes are included in the Bid Sum.

2. ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for ninety days from the bid closing date.

If this bid is accepted by the Owner within the time period stated above, we will:

- Execute the Agreement within seven days of receipt of Notice of Award.

- Commence work on May 30, 2023.

If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required bonds, the security deposit shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

In the event our bid is not accepted within the time stated above, the required security deposit will be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

3. CONTRACT TIME

If awarded this contract, we start construction on May 30, 2023 and complete construction by August 2, 2023.

5. ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

Addendum # Dated

Addendum # Dated

Addendum # Dated

Addendum # Dated

Addendum # Dated

6. APPENDICES

The following documents are attached to and made a condition of the Bid:

Bid security in form of

7. BID FORM SIGNATURES

.....
(Bidder - print the full name of your firm)
was hereunto affixed in the presence of:

.....
(Authorized signing officer Title)

(Seal)

.....
(Authorized signing officer Title)

(Seal)

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.

END OF SECTION 00 4113

DOCUMENT 00 5213 - AGREEMENT

1.1 SUMMARY

- A. Document Includes:
 - 1. Agreement.

1.2 AGREEMENT

- A. AIA Document, Standard Form of Agreement between Owner and Contractor
Where the Basis of Payment is a Stipulated Sum, forms the basis of Agreement
between the Owner and Contractor.

END OF SECTION 00 5213

DOCUMENT 00 7200 - GENERAL CONDITIONS - AIA

1.1 SUMMARY

- A. Document Includes:
 - 1. General Conditions.

1.2 GENERAL CONDITIONS

- A. AIA Document A201-2017, General Conditions of the Contract for Construction, is the General Conditions of the Contract.

1.3 SUPPLEMENTARY CONDITIONS

- A. Refer to Document 00 7300 for modifications to General Conditions.

END OF SECTION 00 7200

DOCUMENT 00 7300 - SUPPLEMENTARY CONDITIONS

1.1 SUMMARY

- A. Document Includes:
 - 1. Supplementary Conditions.

1.2 SUPPLEMENTARY CONDITIONS

- A. These Supplementary Conditions modify the General Conditions of the Contract for Construction, AIA Document A201-2017, and other provisions of the Contract Documents as indicated below. All provisions which are not so modified remain in full force and effect.
- B. The terms used in these Supplementary Conditions which are defined in the General Conditions of the Contract for Construction, AIA Document A201-2017, have the meanings assigned to them in the General Conditions.

Article 1 - Contract Documents

- 1. Add the following Subparagraph 1.1.5.1 as follows:

1.1.5.1- In general, mechanical and electrical drawings are diagrammatic and schematic, and cannot indicate every offset, fitting, and accessory required to avoid all conflict with other trades. Contractor shall check drawings of other trades to verify spaces available and make reasonable modifications, as directed, without extra cost to Owner; maintain headroom and other requirements in all areas; and where such requirements appear inadequate, notify Architect/Engineer before proceeding.

- 2. Add a new Subparagraph 1.2.4 as follows:

1.2.4 Contractor also represents that he has studied all surveys and investigation reports of subsurface and latent physical conditions referred to in the Contract Documents and have made such additional surveys and investigations necessary for the performance of the Work at the Contract Sum and in accordance with the requirements of the Contract Documents, and results of all such data with the requirements of the Contract Documents, and that the Contractor enters into the Contract on the basis of its own examination, investigation and evaluation of all such matters and risks associated with the Work, and not in reliance upon any opinions, statements or representations of the Owner or Architect or any of their respective officers, agents, servants or employees.

- 3. Add a new Subparagraph 1.2.5 as follows:

1.2.5 Contractor represents that he has familiarized himself with, and assumes full responsibility for having familiarized himself with the type, nature, sources, availability and compatibility of all material, systems, products, and equipment specified or which have been proposed or approved as substitutions prior to the execution of the Contract.

4. Add a new Subparagraph 1.2.6 as follows:

1.2.6 "The specifications are, in part, of the brief or "streamlined" type and include incomplete sentences. Omissions of words or phrases such as "The Contractor shall", "as noted on the drawings", "according to the drawings", "a", "an", "the", and "all" are intentional. Omitted words or phrases shall be supplied by reference in the same manner as they are when "note" occurs on the drawings. Words "shall" or "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Words "as per" shall mean "in accordance with". Words "provide" and "work" shall mean furnish, install and connect up complete, in operative conditions and use, all materials, equipment, apparatus and required appurtenances of the particular item to which it has reference. Whenever words "approved", "satisfactory", "directed", "submitted", "inspected", or similar words or phrases are used, it shall be assumed that the word "Architect" follows the verb as the object of the clause, such as "approved by the Architect" and "submitted to the Architect". Where a manufacturer's name is mentioned, words "as manufactured by" or "as made by" shall be understood.

5. Add a new Subparagraph 1.2.7 as follows:

1.2.7 Contractor shall promptly call to the attention of the Owner and Architect any discrepancy or conflict in figures, Drawings, or Specifications that affect its Work. In the event of conflicts or discrepancies between and among the Contract Documents, the Architect shall determine which takes precedence over the other. However, figure dimensions shall take precedence over scale measurements, large scale details shall take precedence over small scale drawings, and drawings of later date shall take precedence over those of earlier date. Any part of the Work shown on the Drawings but not specifically mentioned in the Specifications, or vice versa, shall be considered as part of the Work, the same as though included in both. In the event of an inconsistency or conflict between Drawings and Specifications, or within either document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation. Likewise, the work to be undertaken by Contractor shall include all incidental work necessary as customarily done for the completion of the Project even though it may not be specifically described in the Specifications or Drawings.

6. Add a new Subparagraph 1.2.8 as follows:

1.2.8 In the event of conflicts or discrepancies among the Contract documents, interpretations will be based on the following priorities.

1. The Agreement.
2. Addenda, with those of later date having precedence over those of earlier date.
3. The Supplementary Conditions.
4. The General Conditions of the Contract for Construction.
5. Drawings and Specifications.

In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by Addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation, in every case the more expensive item or method specified or shown shall be figured over any less expensive one. Written dimensions shall be used rather than determined by scale or

rule.

7. Add a new Subparagraph 1.2.9 as follows:

1.2.9 Where reference to codes and standards of technical associations and organizations are made in the Contract Documents, the current edition of such codes and standards shall govern unless specified edition dates are included.

8. Add a new Subparagraph 1.2.10 as follows:

1.2.10 The Drawings, Plans and Specifications for the Work and the Project have been prepared for the Owner by the Architect and, accordingly, the Owner makes any express or implied warranty representing the suitability, adequacy, or accuracy thereof.

Article 2 - Owner

1. Modify Subparagraph 2.3.1 by adding the following sentence to the end thereof:

2.3.1 Contractor shall have no right of action or claim as against the Owner or Architect for or on account of orders or directives for work stoppage if given in good faith upon reasonable belief that sufficient grounds exist therefor.

Article 3 - Contractor

1. Add a new Subparagraph 3.3.1.1 as follows:

3.3.1.1 Contractor shall provide and maintain, in full operation at all times during the performance of the Contract, a sufficient crew of laborers, mechanics and foremen to prosecute the Work with dispatch. The Contractor shall provide a full-time superintendent who shall be on the job during all working periods. Additional provisions pertaining to coordination are included in Division 1, General Requirements, of the Specifications.

2. Add a new Subparagraph 3.4.4 as follows:

3.4.4 Labor shall be performed in a workmanlike manner, by mechanics skilled in their respective trades. Standards of Work required throughout shall be of such grade as will bring results of good workmanship. Mechanics whose Work is unsatisfactory to the Owner or Architect or are considered by either Owner or Architect to be careless, incompetent, unskilled or otherwise objectionable, shall be dismissed from the Work upon notice from the Architect or Owner. Neither the Owner nor Architect shall be responsible for any increased costs of delays caused by such a dismissal.

3. Add a new Subparagraph 3.4.5 as follows:

3.4.5 The Contractor shall perform a criminal history check for all workers including all subcontractors prior to starting work on the project. A list of workers who have successfully passed the criminal history check and who will be working on the project shall be provided to the Owner's representative. Only persons who have successfully passed the criminal history check will be allowed to work on the project. The Contractor

and all subcontractors shall provide written verification to the Owner's representative that all persons working on the project have completed and filed valid I-9 forms and are eligible for employment on the project. No person will be employed by the contractor or any subcontractor that have been found to be the perpetrator of sexual or physical abuse of a minor under the age of 18 years of age; including but not limited to a conviction for any of the following felonies: kidnapping, criminal confinement, rape, criminal deviate conduct, child molesting, child exploitation, vicarious sexual gratification, child solicitation, child seduction, sexual misconduct with a minor or incest. No person shall be employed by and the contractor or any subcontractor that has been convicted of: dealing in or manufacturing cocaine, a narcotic drug or methamphetamine, dealing in a schedule I, II, or III controlled substance as defined by IC-35-48-4-2, dealing in a schedule IV controlled substance as defined by IC 35-48-4-3, dealing in a schedule V controlled substance as defined by IC 35-48-4-4, dealing in a counterfeit substance as defined by IC 35-48-4-10(b) or possession of marijuana, cocaine, a narcotic drug or methamphetamine. The Contractor shall at all times enforce strict discipline at the site and shall remove from the site any persons found by the Owner or Architect to be disorderly, disruptive to the orderly and efficient progress of the Work, or otherwise exhibiting conduct not in compliance with the Contract Documents. Neither the Owner nor Architect shall be responsible for any increased costs or delays caused by such removal.

4. Add a new Subparagraph 3.4.6 as follows:

3.4.6 All labor used throughout the Work and in performance of the Contract shall be acceptable to the Owner and of a standing or affiliation that will permit the Work to be carried on harmoniously and without delay, and that will in no case or under any circumstances cause any disturbance, interference or delay to the progress of the Work. Contractor agrees to proceed with its Work without interruption, regardless of any trade or craft affiliations or the lack thereof on the part of any workmen on the Project. Contractor agrees that where its Work is stopped or delayed or interfered with by strikes, slowdowns or work interruptions resulting from the acts or failures to act of its employees in concert, or by the breach of any of the terms of this provision, then the Owner, at its option, may terminate the Contract and proceed in accordance with the Contractual Documents.

5. Add a new Subparagraph 3.4.7 as follows:

3.4.7 Contractor shall be obligated to perform all work designated by the Owner or Architect as work included within the scope of the Contract Documents notwithstanding a dispute or claim by the Contractor that such work constitutes extra or additional work.

6. Add the following Subparagraphs 3.4.8 and 3.4.9 to 3.4:

- a. 3.4.8 After the Contract has been executed, the Owner and the Architect will consider a formal request of the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications). Refer to Section 01631.
- b. 3.4.9 By making requests for substitutions based on Subparagraph 3.4.8 above, the Contractor:
 1. represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;

2. represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;
 3. certifies that the cost data presented is complete and includes all related costs under his Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and
 4. will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be completed in all respects.
 5. time required by the Architect to review the Contractor's request for substitution shall be compensated by the Contractor through the Owner. Compensation will be on an hourly basis per the Architect's current labor rate schedule for employees involved in the review of the request.
7. Change the second sentence of Subparagraph 3.5.1 to read as follows:
- 3.5.1 All Work not conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective.
8. Add new Subparagraphs 3.5.2 through 3.5.12 as follows:
- a. 3.5.2 For a period of one year from the date of final completion and acceptance of the Work by the Owner, as evidenced by the date of the Architect's Certificate of Completion, the Contractor warrants to the Owner all movable windows, apparatus, machinery, mechanical and electrical equipment. For the same period, the Contractor warrants to Owner to make good, at his own expense, any defects, shrinkages, warpages or other faults in Work required under this Contract arising out of defective materials or workmanship, ordinary wear and tear excepted.
 - b. 3.5.3 As part of the above warranty, it is expressly understood and agreed that the Contractor warrants that the Contractor's portion of the Work shall be waterproof and weatherproof in every respect.
 - c. 3.5.4 The Contractor warrants and represents to the Owner that the Drawings and Specifications for the Work are suitable and adapted for said Work, and guarantees the sufficiency of said Drawings and Specifications for their intended purpose and agrees that it will perform said construction work and complete same to the entire satisfaction of the Owner and Architect.
 - d. 3.5.5 The commencement and terms for the guarantees and warranties provided and required by the Contract Documents shall not in any manner be affected by any delay in the commencement, progress or completion of the Work, regardless of the cause therefor.
 - e. 3.5.6 In addition to all of Contractor's warranties and obligations to correct defective Work provided by law or as set forth in any of the Contract Documents, the Contractor agrees, upon notice from Owner or Architect, immediately to repair, restore, correct and cure, at Contractor's expense, all defects and omissions in workmanship and materials and all failures to comply with the Contract Documents which appear within one (1) year from the date of final completion and acceptance of Work by Owner. Contractor shall pay for, and if requested, correct, repair, restore and cure any damage or injury, whenever the same shall occur or appear,

resulting from any defects, omissions or failure in workmanship and materials, and indemnify, hold harmless, and defend Owner against any and all claims, losses, costs, damages and expenses, including attorney's fees, suffered by Owner as a result of such damage or injury, whenever such damage or injury shall occur or appear.

- f. 3.5.7 The foregoing guarantees and warranties shall not shorten any longer warranty or liability period provided for by law or in the plans, drawings or specifications or otherwise received from Contractor or any subcontractor, material supplier or manufacturer of Contractor nor supersede the terms of any liability for defective Work, but shall be in addition thereto, and shall be in addition to all manufacturer's and factory warranties.
- g. 3.5.8 Notwithstanding anything to the contrary contained herein with respect to warranties, it is understood and agreed that the foregoing warranties and guarantees shall not affect, limit or impair Owner's right against Contractor with regard to latent defects in the Work which do not appear within the applicable warranty period following acceptance of the Work and which could not, by the exercise of reasonable care and due diligence, be ascertained or discovered by Owner within such warranty period. Contractor shall be and remain liable and responsible to correct and cure any such latent defects which are reported to Contractor by Owner in writing within ninety (90) days after such latent defect first appears or could, by the exercise of reasonable care and due diligence, be ascertained or discovered by Owner.
- h. 3.5.9 All guarantees or warranties upon any Work, labor, materials, or equipment by any subcontractor or material supplier of Contractor shall be deemed made by Contractor to Owner. All guarantees and warranties shall survive Owner's final acceptance of the Project. Neither the acceptance of any of the Work by Owner, in whole or in part, nor any payment, either partial or final, by Owner to Contractor, shall constitute a waiver by Owner of any claims against Contractor for defects in the Work, whether latent or apparent, and no such payment or acceptance of the Work by Owner shall release or discharge Contractor or Contractor's surety from any such claims for breach of such warranties.
- i. 3.5.10 Nothing herein intends or implies that the guarantees or warranties shall apply to Work which has been abused or neglected by the Owner or his successor in interest.
- j. 3.5.11 Upon completion of the Work, Contractor shall furnish Owner with copies of all warranties, guarantees, operating manuals relative to equipment installed, and a complete set of reproducible drawings with all field changes noted on them relating to the improvements constructed under the Contract.
- k. 3.5.12 If required by the Owner or the Architect, the Contractor shall deliver to the Owner a signed affidavit stating that, to the best of his knowledge, the Work has been constructed in accordance with the Contract Documents. If such an affidavit is required, the Architect will not recommend final payment or issue a final certificate for payment until such affidavit has been delivered to the Owner.

9. Modify Subparagraph 3.6.1 by adding the following sentence to the end thereon:

3.6.1 The Contract Sum includes the cost of such taxes, and Owner may deduct from the Contractor's account any expense the Owner incurs because of the Contractor's failure to comply with applicable taxing laws, rules or regulations of local, state and federal authorities.

10. Add the following Subparagraph 3.6.2 as follows:

3.6.2 "Materials and properties purchased by Contracts with the Owner that become a permanent part of the structure or constructed facility are not subject to the Indiana Gross Retail Tax (Sales Tax). The Contractor shall obtain a copy of the Owner's Exemption Certificate and then issue copies of this certificate to his suppliers when acquiring materials and products for use in this project. The Contractor shall enforce this exemption clause for all of his purchases and for those of his Subcontractors."

11. Modify Subparagraph 3.7.3 as follows: At the start of this Subparagraph, insert the following:

Contractor represents and warrants that it is familiar with all governmental rules, regulations, laws and ordinances pertaining to the Work.

12. Add the following new Subparagraph 3.7.5 as follows:

3.7.5 The Contractor shall give prior notice to utility companies, make all arrangements and provide all services necessary to discontinue utilities or place same service.

13. Add the following Subparagraph 3.7.6 as follows:

3.7.6 - It is the Contractor's responsibility to perform all construction in accordance with appropriate local, state and national laws, statutes, building codes and requirements. All rated construction shall conform to the requirements of similar construction as tested by UL, or another testing organization recognized by the State of Indiana.

14. Add the following Subparagraph 3.7.7 as follows:

3.7.7 - The Contractor shall provide the owner all necessary and required signed statements that the construction is in compliance with local, state and national laws, statutes, building codes and requirements. These statement must be supplied prior to final payment.

15. Add the following Subparagraph 3.9.4 as follows:

3.9.4 - The Contractor shall not remove the superintendent from the project under any circumstances prior to substantial completion. Exceptions will be made for major illness, incompetence or termination with cause and even so will require the Owner's concurrence. The superintendent can not be removed prior to "Final Completion" without the consent of the Architect/Engineer and written approval of the Owner. The Superintendent shall not be allowed vacation or other time off during the last three months before substantial completion.

16. Add the following Subparagraphs 3.10.4 through 3.10.9 as follows:

- a. 3.10.4 The Owner, if deems necessary, may direct the Contractor to Work overtime, in addition to any overtime required to meet the approved progress schedule as incorporated in the Contract Documents, and if so directed Contractor shall Work said overtime. Provided that the Contractor is not in default under any of the terms or provisions of the Contract or of any of the other Contract Documents, the Contractor will be reimbursed for such actual additional wages paid, if any, at rates which have been approved by the Architect and the Owner plus taxes imposed by law on such additional wages, plus workmen's compensation insurance and levies on such additional wages if required to be paid by the Contractor.
- b. 3.10.5 The following requirements will govern in connection with such additional overtime required under Subparagraph 3.10.4. The Contractor and his Subcontractors shall be required to submit a daily statement of employees by name, trade classification, hourly rate, premium or overtime hours worked, and signed by the Owner to substantiate his premium or overtime charges, all in accordance with the Owner's and standard procedures. These changes shall be submitted weekly for the Owner's records. All such statements shall be submitted in three (3) copy form, including the original statement. The contractor will be reimbursed for the overtime premium and in addition applicable contributions to Federal and State Unemployment Tax and Federal Insurance Contributions Tax. These taxes shall be a percentage factor to be applied to the premium cost. No overhead and profit will be allowed. Each Contractor involved will be required to submit to the Owners, as promptly as possible, an itemized breakdown of the foregoing percentage and shall furnish a photostatic copy of the applicable State unemployment experience rate or a statement from the State Unemployment Security Commission setting forth said experience rate. In addition, in the case of major premium time charge, the union agreements for the trades involved shall be submitted along with the first premium time proposal. Such adjustments shall be subject to an audit by the Architect and the Owner and shall be recorded on the Contractor's books in a manner to facilitate such audit.
- c. 3.10.6 If, however, the progress of the Work or of the Project be delayed by any fault or neglect or act or failure to act of the Contractor or any of its officers, agents, servants, or employees, then the Contractor shall, in addition to all of the other obligations imposed by the Contract upon the Contractor in such cases, and at its own cost and expense, Work such overtime as may be necessary to make up for all time lost to avoid delay in the completion of the Work and of the Project. If, after written notice is given, the Contractor refuses to Work overtime required to make up lost time or to avoid delay in the completion of the Work and of the Project, the Owner may hire others to perform the Work and deduct the cost from the Contractor's Contract amount.
- d. 3.10.7 Should the progress of the Work or of the Project be delayed by any fault or neglect or act or failure to act of the Contractor or any of its officers, agents, servants or employees so as to cause any additional cost, expense, liability or damage to the Owner or Architect, or any damages or additional costs or expenses for which the owner, or

Architect may or shall become liable, the Contractor shall and does hereby agree to compensate the Owner and the Architect and to indemnify them against all such costs, expenses, damages and liability.

- e. 3.10.8 If the Owner considers it necessary for the Contractor or Subcontractor to cease Work at a designated point at any time for the orderly progress of the Work, each Contractor or Subcontractor, when directed by the Owner, shall transfer his men to such point or points as directed, and execute such portions of his Work as required to enable others to properly carry on their Work without delay.
- f. 3.10.9 Additional provisions pertaining to the progress schedule are included in Division 1, General Requirements.

17. Add new Subparagraphs 3.13.2 and 3.13.3 as follows:

- a. 3.13.2 If the Owner requires the Contractor to relocate materials which have been stored on site or within the building, the Contractor shall relocate such materials at no additional cost to the Owner.
- b. 3.13.3 The Contractor is responsible for its site access. The Contractor shall keep roads, walks, ramps, etc. on and adjacent to the Project site in good working order and condition and free from obstructions which might present a hazard to or interference with traffic. When construction operations necessitate the closing of traffic lanes, the Contractor shall be responsible for arranging such closings in advance with the authorities having jurisdiction, the Owner, and adjacent property Owners. The Contractor shall provide adequate barricades, signs and other devices for traffic guides and public safety.

18. Add new Subparagraphs 3.14.3, 3.14.4 and 3.14.5 as follows:

- a. 3.14.3 Cutting and patching shall be performed by the proper trades or crafts necessary for the material involved, but the cost of same shall be borne by the Contractor requiring the cutting and patching.
- b. 3.14.4 Patching shall mean the restoration of a surface or item to its original condition to match the existing adjoining surfaces unless otherwise indicated, noted, detailed or specified.
 - 1. When patching involves painting, special coating, vinyl fabric or other applied finish, the entire surface affected (i.e., wall or ceiling) shall be refinished as a part of this requirement.
- c. 3.14.5 Cutting and patching includes cleaning of all surfaces soiled by this work.

19. Add the following to Subparagraph 3.16:

3.16 - The Owner and Architect shall have access to the work at all times.

Article 7 - Changes in the Work

1. Modify Subparagraph 7.3.6 as follows:

In the last part of the second sentence, delete the words "a reasonable allowance for overhead and profit" and substitute "an allowance for overhead and profit in

accordance with the schedule set forth in Subparagraph 7.3.6 as amended." This cost must include cost of supervision and project management, on or off site, Contractor's off site expense.

In the eighth line, change the word "Architect" to "Owner and Architect's".

2. Add a new Subparagraph 7.3.6.6 as follows:

7.3.6.6 In Subparagraph 7.3.3.3 and 7.3.3.4 the allowance for overhead and profit combined, included in the total cost to the Owner, shall be based on the following schedule:

- a. For the Contractor, the work performed by the Contractor's own forces, ten percent (10%) of the cost.
- b. For the Contractor, for work performed by his Subcontractor, ten percent (10%) of the amount due the Subcontractor.
- c. For each Subcontractor or Sub-Subcontractor involved, for work performed by his own forces, ten percent (10%) of the cost.
- d. For each Subcontractor, for work performed by his Sub-Subcontractors, ten percent (10%) of the amount due the Sub-Subcontractor.
- e. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.1.4.
- f. In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs showing quantities, with unit price of labor and materials for each quantity, including those items furnished by Subcontractors. Where major cost items are subcontracts, they shall be itemized also and a copy of their quotations, itemized as indicated above, shall be included in the proposal. In no case will a change involving over \$500.00 be approved without such itemization.
- g. "Cost" is to include supervision cost.

3. Add a new Subparagraph 7.3.6.7 as follows:

7.3.6.7 No action, conduct, omission, prior failure or course of dealing by the Owner shall act to waive, modify, change or alter the requirements that change orders must be in writing and signed by the Owner and Contractor, and that such written change orders are the exclusive method of effecting any change to the Contract Sum or Contract Time.

The Contractor acknowledges that the Contract Sum and Contract Time cannot be changed by implication, oral agreements, actions, inactions, course of conduct, or constructive change order.

Article 8 - Time

1. Add a new Subparagraph 8.2.3.1 as follows:

8.2.3.1 Inasmuch as the completion of the Project within the prescribed time is dependent upon the close and active cooperation of all those engaged therein, it is, therefore, required that the Contractor shall lay out and install his Work at such time or times and in such manner as consistent with the schedule to permit the carrying

forward of the work of other contractors.

2. Add a new Subparagraph 8.2.4 as follows:

8.2.4 - Except as otherwise provided herein, substantial completion of work shall be within the number of calendar days stated by the Contractor in Proposal Form (Form 96) and shall become a contract obligation. The time for completion of the Work shall be extended for the period of any excusable delay, which term shall include only those delays directly caused by any of the reasons enumerated in the following Sub-Paragraphs 8.3.2 and 8.3.3.

3. Add a new Subparagraph 8.2.5 as follows:

8.2.5 - Completion shall be understood to be substantial completion for the Owner's beneficial occupancy, with only minor "punch list" items yet to be completed and items such as balancing of heating system, etc., which cannot be completed due to climatic conditions.

4. Add a new Subparagraph 8.2.6 as follows:

8.2.6 Whenever it may be useful or necessary for the Owner to do so, before final inspection and acceptance of the Project, the Owner may take possession of the Project or parts thereof at any time that it is determined by the Architect that the construction has been completed to a point where the Owner can occupy or use said Project, or parts thereof, without impairment to Contractor's Work. The Owner may at such time install furnishings and equipment as he sees fit or may at his discretion award separate Contracts for this purpose. It is recognized that some of the Contractor's Work may not be complete at such time and the Contractor shall make all reasonable efforts to complete the Work as quickly as possible. Such use or occupation shall not relieve the Contractor of his guarantee of said Work and materials nor of his obligation to make good at his own expense any defective materials or workmanship which may occur or develop prior to Contractor's release from responsibility to the Owner.

However, the Contractor shall not be responsible for the maintenance of such portion of the Work as may be used or occupied by the Owner, nor for any damage thereto that is due to or caused by the negligence of the Owner during such period of use or occupancy.

5. Modify Subparagraphs 8.3.1 through 8.3.3 by deleting them in their entirety and replace them with the following:

- a. 8.3.1 If the Contractor is delayed at any time in the progress, performance or completion of any portion or portions of the whole of the Work contemplated by its Contract with Owner as the result of flood, cyclone, hurricane, tornado, earthquake or other similar catastrophe, or as the result of Acts of God, the public enemy, Acts of the Government, or fires, epidemics, quarantine restrictions, strikes or labor disputes, freight embargoes or unusual delay in transportation, unavoidable casualties, or on account of any acts or omissions of the Owner, Architect, or others engaged by them (except as herein provided), or by their employees, agents or representatives, or by changes ordered in the Work by the

Owner which are not required to correct problems or discrepancies in the Contractor's Work, or by any other causes which the Contractor could not reasonably control or circumvent, and which are not due to any fault, neglect, act or omission on Contractor's part, and the risks of which are not otherwise assumed by Contractor pursuant to the provisions of the Contract Documents, then the Contract Time for completion of the portion or portions of the Work directly affected by such delay, shall upon timely request of the Contractor, be extended by a period equivalent to the time lost by reason of any and all of the aforesaid causes. Said period shall be as approved and certified by the Architect and the Owner.

- b. 8.3.2 No extension of time shall be granted for delays on account of, or resulting from, weather conditions or other natural phenomenon of normal intensity for the locality or other weather conditions except for the catastrophic weather conditions mentioned in the preceding Subparagraph 8.3.1, unsuitable ground conditions, inadequate construction forces, the failure of the Contractor to place orders for equipment or materials sufficiently in advance to insure their delivery when needed, or delays resulting from interruptions to or suspensions of Contractor's Work so as to enable other contractors to perform their Work.
- c. 8.3.3 Any claim for an extension in the Contract Time shall be based on written notice delivered to Owner and Architect within seventy-two (72) hours of the commencement of the event or occurrence giving rise to the claim. Such notice must set forth (a) the cause of the delay, (b) a description of the portion or portions of the Work affected thereby, and (c) all details pertinent thereto. Notice of the extent of the claim with supporting data, including application for the specific number of days extension of time requested shall be delivered to Owner and Architect within twenty (20) days of such occurrence unless Owner allows an additional period of time to ascertain more accurate data.
- d. 8.3.4 It is a condition precedent to the consideration or prosecution of claims relating to any delays, suspension, hindrance or causes which justify an extension of the Contract Time, that such claims be made and furnished in strict accordance with all applicable time limits provided in this Article. Otherwise, if the Contractor fails to comply, such claims shall be waived, invalid and unenforceable as against the Owner and Architect.

- e. 8.3.5 The Contractor agrees that, whether or not any delay shall be the basis for an extension of time, he shall have no claim against the Owner for an increase in the Contract Price, nor a claim against the Owner or Architect for a payment or allowance of any kind for damage, loss or expense resulting from delays nor shall Contractor have any claim for damage, loss or expense resulting from interruptions to, or suspension of his Work to enable other Contractors to perform their Work. As between the Contractor and Owner, except for delays caused by acts constituting intentional interference by the Owner with the Contractor's performance of its Work when such acts continue after the Contractor's written notice to the Owner of such interference, the Contractor shall assume the risk of all suspensions of, delays in or hindrances to the performance of the Work, regardless of the length thereof, arising from any and all causes whatsoever, including without limitation, those due to any acts or omissions of the Owner, other contractors or subcontractors, except only to the extent that an extension of time may be due to the Contractor as expressly provided for in this Article for such suspension, delay or hindrance. The Contractor shall bear all costs, expenses and liabilities which he may incur in connection with such suspensions, delays or hindrances, and all such suspensions, delays or hindrances, costs, expenses and liabilities of any nature, whatsoever, whether or not provided for in this Contract, shall conclusively be deemed to have been within the contemplation of the parties. The only remedy available to the Contractor shall be an extension of time.
 - 1. 8.3.5.1 The Owner's exercise of any of its rights under the Contract Documents, including but not limited to, its rights regarding changes in the Work, regardless of the extent or number of such changes, performance of separate work or carrying out the Contractor's Work by the Owner directing overtime or changes in the sequence of the Work, withholding payment or otherwise exercising its rights under the provisions of Articles 9 and 14 hereof, or exercising any of its remedies of suspension of the Work or requirements of correction or re-execution of any defective work shall not, under any circumstances, be construed as intentional interference with the Contractor's performance of the Work.
- f. 8.3.6 In the event of a dispute between the Contractor and Owner concerning the period of such time extension, the matter shall be referred to the Architect whose decision thereon shall be final and binding upon the parties. Such extension or extensions of time as determined by the Owner or the Architect shall release and discharge the Owner and the Architect of and from any and all claims of whatever character by the Contractor on account of the aforesaid or any other causes of delay.
- g. 8.3.7 Notwithstanding any provision of this Contract, whether or not relating to the Contract Time, the Owner makes no representation or guarantee as to the date or time that the Project site or any portion thereof will be made available to the Contractor for the performance of the Work, or as to weather conditions at the Project site will be such as to permit the Work to be performed thereon without interruption or by any particular sequence or method or as to whether the performance of the Work can be completed by the time required under this Contract or by

- any other time.
- h. 8.3.8 Whenever in connection with this Contract it is required, expressly or otherwise, that the Owner shall perform any act relating to the Contract, including making available or furnishing any real property, materials, or other things, no guarantee is made by the Owner as to the time of such performance, and delay of the Owner in fulfilling such requirements shall not result in liability of any kind on the part of the Owner except only to the extent that an extension of time may be due as expressly provided for in this Article.

Article 9 - Payments and Completion

1. Add a new Subparagraph 9.2.2 as follows:

9.2.2 The Schedule of Values shall be prepared in a manner that shows each major portion of the Work as a separate line item. The Contractor shall identify those line items of Work that will be accomplished by Subcontractors.

2. Add a new Subparagraph 9.2.3 as follows:

9.2.3 Contractor shall obtain written concurrence in such schedule of values from the Surety furnishing any Performance Bond and Labor and Materials Payment Bond. Copy of written concurrence by the Surety shall be submitted by the time of written submission.

3. Add a new Subparagraph 9.2.4 as follows:

9.2.4 Said schedule shall include a value of two (2) percent closeout cost associated with each subcontractor and is to be clearly itemized on the schedule.

4. Modify Subparagraph 9.3.1 by adding the following:

Two percent closeout cost associated with each subcontractor and is the end thereof:

- a. 9.3.1 Progress payment requests shall be to be clearly itemized on the schedule. submitted on a notarized AIA Document G702, Application and Certificate for Payment, supported by AIA G703, Continuation Sheet. These requests shall detail the value of the various materials stored on the site and the value of the various types of labor performed during the period of time since the previous payment request. The Contractor shall attach to each payment request, a statement certifying that all payments due the Contractor from previously issued Certificates for Payment have been paid. Contractor shall furnish such additional supporting data substantiating the Contractor's right to payment as the Owner or Architect may require.

Payment will be recommended by Architect, and approved by the Owner, based on ninety percent (90%) of the estimated value of labor performed and materials incorporated in the Work, plus ninety percent (90%) of the value of non-perishable materials suitably stored at the site. Stored

materials shall not be removed from the site without permission of the Owner.

- b. Add the following Subparagraphs 9.3.1.3 through 9.3.1.6 as follows:
 - 1. 9.3.1.3 - Until the Work is 50 percent complete, the Owner shall pay 90 percent of the amount due the Contractor on account of progress payments. At the time Work is 50 percent complete and thereafter, the Architect will authorize remaining partial payments to be paid in full.
 - 2. 9.3.1.4 - Until his Subcontract is fifty percent (50%) complete, a Subcontractor shall be paid ninety percent (90%) of the earned sum by the Contractor. At the time his Subcontract is fifty percent (50%) complete, if the manner of completion of his Subcontract and its progress are and remain satisfactory to the Contractor and the Architect/Engineer, and in the absence of other good and sufficient reasons, he shall be paid in full on the remaining progress payments.
 - 3. 9.3.1.5 - The full contract retainage may be reinstated if the manner of completion of the work and its progress do not remain satisfactory to the Architect/Engineer, or the Owner, or for other good and sufficient reasons.
 - 4. 9.3.1.6 - The Owner, Contractor, and the Architect/Engineer shall cooperate to the end that retentions shall be paid promptly when all conditions of the contract have been met.

- 5. Add the following Subparagraphs 9.3.2.1 to 9.3.2 as follows:

9.3.2.1 - Payment for Stored Material and Equipment will be made if the Contractor includes with each monthly request the following two paragraphs to certify that all material and equipment for which payment is requested is in fact paid for the Contractor and becomes the property of the Owner. The Architect reserves the right to observe building materials, stored off-site, for which the Contractors are requesting payment. If building materials are stored more than five miles from the project site or the Architect's office, the Prime Contractor requesting payment shall compensate the Architect both for time and expense in making this review.

- a. "The Contractor certifies that all stored materials included in this Application for Payment are free and clear of all liens, claims, security interests and encumbrances and that no work, materials, or equipment covered hereby is subject to any retained interest by any other person."
- b. "Title to all work materials and equipment covered by this Application for Payment which has not heretofore passed to the Owner is hereby conveyed and transferred to the Owner effective upon payment of this Application for Payment."

- 6. Add the following to Subparagraph 9.4.3:

"ESCROW ACCOUNT FOR RETAINAGE, applicable to contracts in amounts of \$100,000 or more, in accordance with Indiana Statutes."

- 7. Add new Subparagraph 9.5.4 as follows:

9.5.4 In the event Owner withholds any payment, partial or final, from the Contractor by virtue of Contractor's failure to make payments properly to subcontractors, laborers, and material suppliers for labor, materials, and/or equipment furnished to the Project, Owner may, but shall not be obligated or required to, make direct payment on behalf of Contractor of any part or all of such sums due and owing to said subcontractors, material suppliers and/or laborers for their labor, materials or equipment furnished to the Project, not to exceed the Contract Sum remaining due and owing to Contractor, and charging all such direct payments against the Contract Sum under the Contract. Before making any such direct payments for labor, materials or equipment, Owner first shall give Contractor three (3) days' written notice stating Owner's intention to make such payment and setting forth the names of the subcontractors, material suppliers and/or laborers which Owner intends to pay directly, the amounts to be paid them, and the reason therefor. If Contractor does not pay or otherwise satisfy such bills, statements and/or claims of the parties so identified within two (2) days after receipt of such notice or give Owner satisfactory assurances that the same will be paid or otherwise satisfied, Owner may proceed with such payment; provided, however, nothing contained in this paragraph shall create any personal liability on the part of the Owner to any subcontractor, material supplier or laborer, or any direct contractual relationship between Owner and them.

8. Add new Subparagraph 9.5.5 as follows:

9.5.5 If any claim or lien is made or filed with or against the Owner, the Project, real estate, or contract proceeds by any person claiming that Contractor or any subcontractor or other person for whom Contractor is liable has failed to make payment for labor, services, materials, equipment, taxes or other items or obligations furnished or incurred for or in connection with the Work, or if any time there shall be evidence of such non-payment or of any claim or lien which is chargeable to Contractor, or if Contractor or any subcontractor or other person for whom Contractor is liable causes damage to the Work or to any other Work on the Project, or if Contractor fails to perform or is otherwise in default under any of the terms or provisions of the Contract Documents, Owner shall have the right to retain from any payment then due or thereafter to become due an amount which it deems sufficient to (1) satisfy, discharge and/or defend against such claim or lien or any action which may be brought or judgment which may be recovered thereon, (2) make good any such non-payment, damage, failure or default, and (3) compensate the Owner and Architect for and indemnify them against any and all losses, liability, damages, costs, expenses including legal fees and disbursements which may be sustained or incurred by either or both of them in connection therewith. Owner shall have the right to apply and charge against Contractor so much of the amount retained as may be required for the foregoing purposes. If the amount retained is insufficient therefor, Contractor shall be liable for the difference and shall pay the same to the Owner.

9. 9.6 - "Progress Payments". Add the following to 9.6.1 and Subparagraphs 9.6.8 through 9.6.13 to 9.6:

- a. 9.6.1 - The Schedule of Values so prepared by the Contractor, reviewed by the Architect/Engineer, and concurred by the Surety, shall constitute the basis of progress payments to the Contractor, and payments made pursuant to regards the Architect, the Contractor and the Surety on any bonds be deemed properly made at the request of the Contractor and the Surety.

- b. 9.6.8 - Upon commencement of the Work, an escrow account shall be established in a financial institution chosen by the Contractor and approved by the Owner.
- c. 9.6.9 - The escrow agreement shall provide that the financial institution will act as escrow agent, will pay interest on funds deposited in such account in accordance with the provisions of the escrow agreement and will disburse funds from the account upon the direction of the Owner as set forth below. Compensation to the escrow agent for establishing and maintaining the escrow account shall be paid from interest accrued in the escrow account.
- d. 9.6.10 - As each progress payment is made, the retainage with respect to that payment shall be deposited by the Owner in the escrow account.
- e. 9.6.11 - Interest earned on retainage will be maintained proportionally to the amount of retainage which is maintained, and any retainage which is released to the contractor will also be released with the appropriate amount of interest earned at the time that the retainage is released to the Contractor.
- f. 9.6.12 - When the Contractor has fulfilled all of the requirements of the Contract providing for reduction of retained funds, the escrow agent shall release to the Contractor one-half of the accrued funds but none of the interest thereon. When the work has been fully completed in a satisfactory manner and the Architect has issued a final Certificate for Payment, the escrow agent shall pay to the Contractor the full amount of funds remaining in the account, including net balance of the interest paid to the account, but less any interest that may have accrued for the benefit of the Owner, which shall be paid for the Owner.
- g. 9.6.13 - If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor, the escrow agent shall make payment to the Contractor as provided in Subparagraph 9.10.3

10. Add new Subparagraph 9.10.6 as follows:

9.10.6 - Final Payment, including all escrowed principal and escrowed income shall be due within sixty-one (61) days following the Date of Substantial Completion, as defined above. If at that time there are any remaining uncompleted minor items, an amount equal to two hundred percent (200%) of the value of each item as determined by the Architect/Engineer shall be withheld until all such items are complete. The cost of the review estimate and other efforts necessary to establish the value of the incomplete work will be deducted from the remaining funds owed to the Contractor.

11. Add Paragraph 9.11 and Subparagraph 9.11.1 as follows:

- a. 9.11 - Owner cost incurred due to incomplete work.
- b. 9.11.1 - The Contractor and the Contractor's surety, if any, shall be liable for and shall pay the Owner all sums incurred and attributable to the work not being completed within the number of days stated on the bid form including extensions of time properly granted and within 60 days after Substantial Completion.

Article 10 - Protection of Persons and Property

1. Modify Subparagraph 10.2.2 by adding the following sentence to the end thereof:

10.2.2 The Contract Sum includes the cost of such notices and compliance, and Owner may deduct from the Contractor's account any expense the Owner incurs because of the Contractor's failure to comply with such laws, ordinances, rules, regulations and lawful orders.

2. Add a new Subparagraph 10.2.4.1 as follows:

10.2.4.1 - When use or storage of explosives and other hazardous materials or equipment or unusual methods are necessary, the Contractor shall give the Owner reasonable advance notice.

3. Add a new Subparagraph 10.2.8 as follows:

10.2.8 The Contractor shall comply with all applicable safety recommendations of the Associated General Contractors of America, American National Standards Institute and National Fire Protection Association, the Occupational Safety and Health Act, and all special safety and security requirements of the Owner. If any inconsistency exists between the provisions of this Subparagraph 10.2.8 and Subparagraph 10.2.2, Subparagraph 10.2.2 shall take precedence.

4. Add a new Subparagraph 10.2.9 as follows:

10.2.9 All damage, injury or loss to any property referred to in Paragraph 10.2 caused, directly or indirectly, in whole or in part, by Contractor, any subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, shall be remedied by Contractor. Contractor's duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed and accepted by Owner.

5. Add a new Subparagraph 10.2.10 as follows:

10.2.10 Contractor shall indemnify, save harmless and defend Owner from any liability, including any and all claims, damages, losses, costs, attorneys' fees and other professional fees, resulting from any violation of all such applicable laws, ordinances, rules, regulations, lawful orders and safety requirements referred to in Paragraph 10.2.

Article 11 - Insurance

1. Delete Subparagraph 11.1.2 in its entirety and substitute the following:

11.1.2 The Contractor shall not commence the Work until he has obtained all insurance required under this section and has submitted a Certificate of Insurance form to the Owner. Certificates shall be furnished on AIA Document G705 or the Accord Form and submitted to the Architect, in duplicate, at least five (5) days prior to starting Work. The Certificate shall provide for sixty (6) days prior written notice to the Owner and Architect of policy cancellation or of material change. If requested, a certified copy of the policies shall be submitted to the Architect for his review. The Owner, the Owner's Representative and the Architect shall be named as additional insureds for those insurance coverages carried and maintained by the Contractor except as

respects workers' compensation. The Contractor shall maintain the above insurance at all times until completion of the Work or later, as provided in the Contract Documents.

2. Add a new Subparagraph 11.1.2.1 as follows:

11.1.2.1 In the event the Contractor engages Subcontractors for all of a portion of the Work required by its Contract, the Contractor will require any and all Subcontractors to also assume all of the duties, obligations and requirements in this Article. The Contractor shall require such Subcontractors to provide Certificates of Insurance evidencing the insurance, and naming the Contractor, Architect, and Owner as additional insureds, except as respects worker's compensation insurance, and that the insurance carried and maintained by the Subcontractor meets all of the requirements of this Article. The Contractor shall not permit any Subcontractor to commence Work until a Certificate of such insurance has been submitted and on file with the Contractor.

3. Add a new Subparagraph 11.1.2.2 as follows:

11.1.2.2 The Contractor's Commercial General Liability Insurance shall include premises - operations (including explosion, collapse and underground coverage) elevators, independent contractors, products liability, completed operations, and blanket contractual liability on all written contracts, all including broad form property damage coverage.

4. Add a new Subparagraph 11.1.2.3 as follows:

11.1.2.3 The Contractor's Commercial, General and Automobile Liability Insurance, as required by Subparagraphs 11.1.1, 11.1.2, 11.1.2.1 and 11.1.2.2 shall be written for not less than limits of liability as follows, or as required by law, whichever is greater, and shall name the Owner and Project Manager as additional insureds:

- | | | |
|----|---|--|
| a. | Worker's Compensation
Employer's Liability | Statutory
\$1,000,000 Each Accident |
| b. | Commercial General
Liability | Bodily Injury &
Property Damage |
| | Commercial Form
Including:
Premises-Operations | \$2,000,000 Each
Occurrence |
| | Explosion & Collapse
-Hazard | \$2,000,000 General
Aggregate |
| | -Underground Hazard
-Products/Completed
Operational Hazard
Contractual Insurance | \$2,000,000 Product/
Completed Operation
Aggregate |
| | -Broad Form Property | |

Damage

-Independent Contractors

-Personal Injury (with
Contractual and
Employee Exclusions
Deleted)

\$2,000,000 Personal
Injury

- c. Comprehensive Automobile
Liability (Including Owned,
Non-Owned, and Hired
Vehicles)

Bodily Injury and Property
Damage Combined Single
Limit \$2,000,000

5. Add a new Subparagraph 11.1.2.4 as follows:

11.1.2.4 For all worker's compensation and employer's liability insurance required hereby, Contractor shall require waiver of subrogation for itself and for all subcontractors, or others performing Work on the Project pursuant to the terms of Contractor's Contract with Owner.

6. Add a new Subparagraph 11.1.2.5 as follows:

11.1.2.5 Commercial General Liability Insurance may be arranged under a single policy for the full limits required or by a combination of underlying policies with the balance provided by an Excess or Umbrella Liability Policy in the amount of \$5,000,000.

7. Delete Subparagraph 11.4.1 and substitute the following:

11.4.1 - The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds may be obtained through the Contractor's usual source and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal to one hundred percent (100%) of the Contract Sum.

- a. 11.4.1.1 - The Contractor shall deliver the required bonds to the Owner not later than three (3) days following the date the Agreement is entered into, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.
- b. 11.4.1.2 - The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

8. Add a new Subparagraph 11.4.3 as follows:

11.4.3 - Each Contractor to whom awards are made, shall furnish a Performance Bond

and Labor and Material Payment Bond with submission of his Contract to the Owner. The Contractor shall use a Surety for this Performance Bond and Labor and Material Payment Bond one of the acceptable companies listed in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies": Circular 570, latest Revision, Department of the Treasury. The Contractor shall use a surety company that can underwrite the entire amount of the Performance Bond and Labor and Material Payment Bond. Underwriting limitations for the acceptable companies are also contained in Circular 570. Said Performance Bond and Labor and Material Payment Bond shall be in amount not less than the following percentage of the Contract Sum:

One hundred percent (100%)

Performance Bond and Labor Material Payment Bond shall be security for the following:

The faithful performance of all provisions of the Contract and satisfactory completion of the work included thereunder.

The payment of all persons performing labor and furnishing materials in connection with the Contract.

The covering of all guarantees included herein.

The addition to the paragraphs above, this Bond shall guarantee the Owner for a period of one (1) year after the date of acceptance of the work by the Owner that all workmanship and materials performed and furnished as part of this Contract are in accordance with the Drawings and Specifications and that the Contractor shall remove any defects due to faulty workmanship and/or materials that shall appear within the guarantee period.

Article 12 - Uncovering and Correction of Work

1. Add a new Subparagraph 12.2.6 as follows:

12.2.6 Contractor shall return to project up to 24 months from date of substantial completion to repair all masonry cracks inside or out, and establish new control joints as required.

Article 13 - Miscellaneous Provisions

1. Modify Subparagraph 13.2.1 by adding the following to the end thereof:

13.2.1 Neither this Contract nor any monies due or to become due hereunder shall be assignable without the prior written consent of the Owner, neither shall the whole or any part of this Contract be sublet without such prior written consent. Any such assignment or subletting without prior written consent by the Owner shall be void and of no effect and shall vest no right of action in the assignee or subcontractor as against the Owner or Architect. Owner's consent to any subletting shall not be deemed to create any contractual relationship between

the Owner and any subcontractor to whom the work or any portion thereof is sublet and shall not vest any right or right of action in such subcontractor against Owner.

2. Add a new Subparagraph 13.4.3 as follows:

13.4.3 Every provision of the Contract is intended to be severable such that, if any term or provision thereof is illegal or invalid for any reason whatsoever, such provision shall be severed from the Contract and shall not affect the validity of the remainder of the Contract. A waiver of any breach or default under the Contract shall not constitute a waiver of any other breach or default of any provision hereunder.

3. Add a new Subparagraphs 13.5.7, 13.5.8, 13.5.9, 13.5.10 and 13.5.11 as follows:
- a. 13.5.7 Where materials are specified to conform to the standard specifications of the American Society for Testing and Materials, American Concrete Institute, American Institute of Steel Construction, other recognized technical organizations with the Federal Government, but testing is not required in connection therewith, the Contractor shall furnish certificates to the Architect and Owner's Representative as evidence that the proposed products meet requirements of standard specifications cited.
 - b. 13.5.8 Notices required by this Paragraph shall be delivered in writing to the Architect no less than three (3) days prior to inspection, test or approval date. Notices shall specify the location and time that inspection, test or approval will be made.
 - c. 13.5.9 If any portion of the Work to be inspected, tested or approved under the observation of the Architect or Owner is not ready for such inspections, tests or approvals at the time designed in the Contractor's notice to the Architect, the Contractor shall bear all costs for Architect's additional services made necessary by such delay.
 - d. 13.5.10 Certificates of inspection or testing shall indicate if that portion of the Work inspected or tested meets the minimum requirements of the standard or regulation specified. Certificates shall include the name of Contractor, name of Project and location and date inspection or test was conducted.
 - e. 13.5.11 Additional provisions pertaining to testing are included in Division 1 - General Requirements, and in Sections relating to specific work involved.

5. Add a new Subparagraph 13.8.1 as follows:

13.8.1 The Contractor shall comply with all federal, state, and municipal and local rules, ordinances, rules, regulations, orders, notices and requirements relating to non-discrimination in employment, fair employment practices, and equal employment opportunity, whether or not provided elsewhere in the Contract Documents without additional charge or expense to the Owner, and shall be responsible for and correct, at its own cost and expense, any violations thereof resulting from or in connection with the performance of the Work. Contractor shall at any time upon demand, furnish such proof as the Owner may require to demonstrate compliance with such requirements and correction of any violations. Contractor agrees to save harmless and indemnify the Owner, the Owner's Representative, and Architect from and against any and all loss,

injury, claims, actions, damages, costs and expenses, including legal fees and disbursements, caused or occasioned directly or indirectly by the Contractor's failure to comply with any of said laws, ordinances, rules, regulations, orders, notices or requirements, or to correct violations.

6. Add a new Subparagraph 13.8.2 as follows:

13.8.2 Contractor shall maintain policies of employment as follows:

1. Pursuant to the requirements of Indiana Code S22-91-10 and S5.16-6-1, Contractor and his Subcontractors may not discriminate against any employee or applicant for employment to be employed in the performance of such contract, with respect to his hire, tenure, terms, conditions or privileges of employment of any matter directly or indirectly related to employment because of his race, religion, color, sex, handicap, national origin or ancestry. The Contractor and Subcontractor, if any, agrees to comply with all the provisions contained in the Equal Opportunity Clause quoted in Executive Orders No. 11246 and No. 11375. In addition, the Contractor shall cause this Equal Opportunity Clause to be included in the subcontracts or purchase orders hereunder unless exempted by rules, regulations and orders of the Secretary of Labor issued pursuant to Section 204 of the executive Orders No. 11246 and No. 11375 as amended. Breach of this covenant may be regarded as a material breach of contract.
2. Contractor and Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them on their behalf, state all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, handicap, national origin or ancestry.

7. Add a new Subparagraph 13.9.1 as follows:

13.9.1 The Contractor affirms under the penalties of perjury that it does knowingly employ an unauthorized alien. The Contractor shall enroll in and verify the work eligibility status of all its newly hire employees through the E-Verify program as defined in IC 22-5-1.7-3. The Contractor shall not knowingly employ or contract with an unauthorized alien. The Contractor shall not retain and employee or contract with a person the Contractor subsequently learns is an unauthorized alien. The Contractor shall require its Subcontractors, who perform work under this Agreement, to certify to the Contractor that the Subcontractor has enrolled and is participating in the E-Verify program. The Contractor agrees to maintain this certification throughout the duration the term of an agreement with a Subcontractor. In addition to the Owner's right to terminate under other provision of this Agreement, the Owner may terminate for default if the Contractor fails to cure a breach of this provision.

8. Add a new Subparagraph 13.10.1 as follows:

13.10.1. As required by IC 5-22-16.5, the Contractor certifies that it is not engaged in investment activities in Iran or agency or instrumentality of the government of Iran, as defined and regulated by Senate Enrolled Act 231, effective July 1, 2012. Providing false certification may result in the consequences listed in IC 5-22-16.5-14, including termination of the Agreement and denial of future agreements, as well as an imposition of civil penalty.

Article 14 - Termination of the Contract

1. Add a new Subparagraph 14.2.5 as follows:

14.2.5 The Contract may be terminated by the Owner in whole or in part without cause and for its convenience on three (3) days written notice to the Contractor. In the event of such termination for convenience, the Contractor shall be compensated for that portion of the contract sum earned to the date of termination, but Owner shall not be liable for any additional or other consequential damages. Such entitlement of Contractor shall constitute Contractor's sole and exclusive remedy and recovery, and in no event shall the Contractor be entitled to recover anticipated profits and overhead on unperformed Work by reason of such termination for convenience.

2. Add a new Subparagraph 14.2.6 as follows:

14.2.6 Owner shall have the right to terminate the Contract at any time upon three (3) days' written notice to contractor in the event Owner is unable to obtain or maintain financing for the portion of the Work as yet unfinanced or uncompleted. Owner shall be obligated to pay Contractor that portion of the Contract Sum earned to the date of termination, but Owner shall not be liable for any additional or other consequential damages.

3. Add a new Subparagraph 14.2.7 as follows:

14.2.7 The occurrence of any labor dispute, work stoppage, strike (including sympathetic strike), slow down, picketing, or any other activity directly or indirectly attributable to Contractor's employees, either caused by them or resulting from their employment on the Project which interrupts, interferes with or delays the Work of Contractor or other separate contractors shall constitute a breach of Contract. In such event, the Owner shall have the right, in addition to any other rights and remedies provided by this Contract or the Contract Documents, or by law, following two (2) days' written notice to the Contractor, to terminate this Contract or any part thereof for all or any portion of the Work, and for purpose of completing the Work, to enter upon the premises and take possession in the same manner, to the same extent, and upon the same terms and conditions as set forth in Subparagraph 14.2.3.

4. Add a new Subparagraph 14.2.8 as follows:

14.2.8 If termination of the Contract is effectuated by Owner for cause resulting from Contractor's failing to substantially perform in accordance with the terms of the Contract, and it is subsequently found or determined in legal proceedings that the Contractor was not in substantial breach of the Contract by failure to perform in accordance with its terms, or that such failure was caused through fault of the Owner, then such termination shall be deemed to be a termination for convenience pursuant to Subparagraph 14.2.1, and the Contractor's remedy and recovery as against the Owner shall, in such case, be limited to the payments provided by such Subparagraph 14.2.1

END OF SECTION 00 7300

SECTION 01 2000 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Alternates.
- B. Schedule of values.
- C. Applications for payment.
- D. Change procedures.

1.2 ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work.
- C. Schedule of Alternates:
 - 1. Alternate No. 1: State the amount to be added to the Base Bid for providing finishes in the bathroom including plumbing fixtures. Base Bid shall include walls, ceiling, lighting and plumbing rough-ins.

1.3 SCHEDULE OF VALUES

- A. Submit printed schedule on AIA Form G703 - Continuation Sheet for G702.
- B. Submit Schedule of Values in duplicate within 15 days after date of Notice to Proceed.
- C. Format: Utilize Table of Contents of this Project Manual. Identify each line item with number and title of major specification Section. Separate material and labor costs. Identify site mobilization, bonds and insurance.
- D. Include in each line item, amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by unit cost to achieve total for each item.
- E. Include within each line item, direct proportional amount of Contractor's overhead and profit.
- F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.4 APPLICATIONS FOR PAYMENT

- A. Submit five copies of each application on AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702.
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Submit updated construction schedule with each Application for Payment.
- D. Payment Period: Submit at intervals stipulated in the Agreement.
- E. Submit with transmittal letter.
- F. Submit waivers required by the Owner.
- G. Substantiating Data: When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:
 - 1. Current construction photographs.
 - 2. Partial release of liens from major subcontractors and vendors.
 - 3. Affidavits attesting to off-site stored products and insurance.
 - 4. Construction progress schedules, revised and current.

1.5 CHANGE PROCEDURES

- A. Submittals: Submit name of individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
- B. The Architect/Engineer will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions on AIA Form G710.
- C. The Architect/Engineer may issue a Proposal Request including a detailed description of proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with stipulation of overtime work required and the period of time during which the requested price will be considered valid. Contractor will prepare and submit estimate within 7 days.
- D. Contractor may propose changes by submitting a request for change to Architect/Engineer, describing proposed change and its full effect on the Work. Include a statement describing reason for the change, and effect on Contract Sum/Price and Contract Time with full documentation and a statement describing effect on Work by separate or other Contractors. Document requested substitutions.

- E. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for Change Order as approved by Architect/Engineer.
- F. Construction Change Directive: Architect/Engineer may issue directive, on AIA Form G713 Construction Change Directive signed by Owner, instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute change.
- G. Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract. Architect/Engineer will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.
- H. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.
- I. Document each quotation for change in cost or time with sufficient data to allow evaluation of quotation.
- J. Change Order Forms: AIA G701.
- K. Execution of Change Orders: Architect/Engineer will issue Change Orders for signatures of parties as provided in Conditions of the Contract.
- L. Correlation Of Contractor Submittals:
 - 1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
 - 2. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
 - 3. Promptly enter changes in Project Record Documents.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION 01 2000

SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coordination and project conditions.
- B. Preconstruction meeting.
- C. Progress meetings.
- D. Pre-installation meetings.
- E. Cutting and patching.
- F. Special procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.
- C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's occupancy.
- F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 PRECONSTRUCTION MEETING

- A. Architect/Engineer will schedule meeting after Notice of Award.

- B. Attendance Required: Owner, Architect/Engineer, and Contractor and Subcontractors.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of schedule of values and progress schedule.
 - 5. Designation of personnel representing Owner, Architect/Engineer and Contractor.
 - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 7. Use of premises by Owner and Contractor.
 - 8. Owner's requirements.
 - 9. Construction facilities and controls.
 - 10. Temporary utilities.
 - 11. Security and housekeeping procedures.
 - 12. Schedules.
 - 13. Application for payment procedures.
 - 14. Procedures for testing.
 - 15. Procedures for maintaining record documents.
- D. The Architect/Engineer will record minutes and distribute copies to participants and those affected by decisions made.

1.4 PROGRESS MEETINGS

- A. The Architect will Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.
- B. Architect/Engineer will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required: Contractor's Project Manager, Job superintendent, and Architect/Engineer's representative.
- D. Agenda:
 - 1. Progress to date.
 - 2. Anticipated progress next 30 days.
 - 3. Identification of problems impeding planned progress.
 - 4. Review of submittals schedule and status of submittals.
 - 5. Maintenance of progress schedule.
 - 6. Corrective measures to regain projected schedules.
 - 7. Review of Requests For Information (RFI's).
 - 8. Review of Architect's Supplemental Instructions (ASI's).
 - 9. Review of Proposal Requests (PR's).
 - 10. Review of Change Orders (CO's).
 - 11. Review of Pay Applications.

ADMINISTRATIVE REQUIREMENTS

12. Review of submittals schedule and status of submittals.
 13. Owner discussions, concerns and comments.
 14. Architect discussions, concerns and comments.
 15. Other business relating to Work.
- E. The Architect will record minutes and distribute copies to participants and those affected by decisions made.

1.5 PRE-INSTALLATION MEETINGS

- A. When required in individual specification sections, convene pre-installation meetings at Project site prior to commencing work of specific section.
- B. Require attendance of parties directly affecting, or affected by, Work of specific section.
- C. Notify Architect/Engineer four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
1. Review conditions of installation, preparation and installation procedures.
 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with copies to the Architect/Engineer, and the Owner, and those affected by decisions made.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 CUTTING AND PATCHING

- A. Employ skilled and experienced installer to perform cutting and patching.
- B. Submit written request in advance of cutting or altering elements affecting:
1. Structural integrity of element.
 2. Integrity of weather-exposed or moisture-resistant elements.
 3. Efficiency, maintenance, or safety of element.
 4. Visual qualities of sight exposed elements.
 5. Work of Owner or separate contractor.
- C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
1. Fit the several parts together, to integrate with other Work.

2. Uncover Work to install or correct ill-timed Work.
 3. Remove and replace defective and non-conforming Work.
 4. Remove samples of installed Work for testing.
 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
- D. Execute work by methods to avoid damage to other Work, and to provide proper surfaces to receive patching and finishing.
- E. Cut masonry and concrete materials using masonry saw or core drill.
- F. Restore Work with new products in accordance with requirements of Contract Documents.
- G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07840, to full thickness of penetrated element.
- J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.
- K. Identify hazardous substances or conditions exposed during the Work to Architect/Engineer for decision or remedy.

3.2 SPECIAL PROCEDURES

- A. Materials: As specified in product sections; match existing with new products and salvaged products for patching and extending work.
- B. Employ skilled and experienced installer to perform alteration work.
- C. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.
- D. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.
- E. Remove debris and abandoned items from area and from concealed spaces.
- F. Prepare surface and remove surface finishes to permit installation of new work and finishes.
- G. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

- H. Remove, cut, and patch Work in manner to minimize damage and to permit restoring products and finishes to original condition.
- I. Refinish existing visible surfaces to remain in renovated rooms and spaces, to renewed condition for each material, with neat transition to adjacent finishes.
- J. Where new Work abuts or aligns with existing, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.
- K. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and submit recommendation to Architect/Engineer for review.
- L. Where change of plane of $\frac{1}{4}$ inch (6 mm) or more occurs, submit recommendation for providing smooth transition; to Architect/Engineer for review.
- M. Trim existing doors to clear new floor finish. Refinish trim to original condition.
- N. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.
- O. Finish surfaces as specified in individual product sections.

END OF SECTION 01 3000

SECTION 01 3216 - NETWORK ANALYSIS SCHEDULES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. References.
- B. Quality assurance.
- C. Format.
- D. Schedules.
- E. Submittals.
- F. Review and evaluation.
- G. Updating schedules.
- H. Distribution.

1.2 REFERENCES

- A. The Use of CPM in Construction - A Manual for General Contractors and the Construction Industry, Washington, D.C., The Associated General Contractors of America (AGC).

1.3 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel specializing in CPM scheduling with five years minimum experience in scheduling construction work of complexity comparable to this Project and having use of computer facilities capable of delivering detailed graphic printout within 48 hours of request.
- B. Contractor's Administrative Personnel: Five years minimum experience in using and monitoring CPM schedules on comparable projects.

1.4 FORMAT

- A. Listings: Reading from left to right, in ascending order for each activity. Identify each activity with applicable specification section number.
- B. Scale and Spacing: To allow for notations and revisions.

1.5 SCHEDULES

- A. Prepare network analysis diagrams and supporting mathematical analyses using Critical Path Method, under concepts and methods outlined in AGC's "The Use of CPM in Construction - A Manual for General Contractors and the Construction Industry".

- B. Illustrate order and interdependence of activities and sequence of work; how start of given activity depends on completion of preceding activities, and how completion of activity may restrain start of subsequent activities.
- C. Illustrate complete sequence of construction by activity, identifying work of separate stages, floors, etc. Indicate dates for submittals and return of submittals; dates for procurement and delivery of critical products; and dates for installation and provision for testing. Include legend for symbols and abbreviations used.
- D. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
 - 1. Preceding and following event numbers.
 - 2. Activity description.
 - 3. Estimated duration of activity, in maximum 15-day intervals.
 - 4. Earliest start date.
 - 5. Earliest finish date.
 - 6. Actual start date.
 - 7. Actual finish date.
 - 8. Latest start date.
 - 9. Latest finish date.
 - 10. Total and free float; accrue float time to Owner and to Owner's benefit.
 - 11. Monetary value of activity, keyed to Schedule of Values.
 - 12. Percentage of activity completed.
 - 13. Responsibility.
- E. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, of accepting revised completion dates, and recomputation of scheduled dates and float.
- F. Required Sorts: List activities in sorts or groups:
 - 1. By preceding work item or event number from lowest to highest.
 - 2. By longest float, then in order of early start.
 - 3. By responsibility in order of earliest possible start date.
 - 4. In order of latest allowable start dates.
 - 5. In order of latest allowable finish dates.
 - 6. Contractor's periodic payment request sorted by Schedule of Values listings.
 - 7. Listing of basic input data generating report.
 - 8. Listing of activities on critical path.
- G. Prepare sub-schedules for each stage of Work.
- H. Coordinate contents with schedule of values.

1.6 SUBMITTALS

- A. Within 10 days after date established in Notice to Proceed, submit proposed preliminary network diagram defining planned operations for first 60 days of Work, with general outline for remainder of Work.
- B. Participate in review of preliminary and complete network diagrams jointly with Architect/Engineer.
- C. Within 20 days after joint review of proposed preliminary network diagram, submit draft of proposed complete network diagram for review. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete network analysis consisting of network diagrams and mathematical analysis.
- E. Submit updated network schedules for each Progress Meeting.

1.7 REVIEW AND EVALUATION

- A. Participate in joint review and evaluation of network diagrams and analysis with Architect/Engineer at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise network diagrams and analysis incorporating results of review, and resubmit within 14 days.

1.8 UPDATING SCHEDULES

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity. Update diagrams to graphically depict current status of Work.
- C. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- D. Indicate changes required to maintain Date of Substantial Completion.
- E. Submit sorts required to support recommended changes.
- F. Prepare narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken or proposed and its effect including effects of changes on schedules of separate contractors.

1.9 DISTRIBUTION

- A. Following joint review, distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, Architect/Engineer, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION 01 3216

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Submittal procedures.
- B. Product data.
- C. Shop drawings.
- D. Samples.
- E. Test reports.
- F. Certificates.
- G. Manufacturer's instructions.
- H. Manufacturer's field reports.

1.2 SUBMITTAL PROCEDURES

- A. Transmit each submittal with Architect/Engineer accepted form.
- B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.
- C. Identify Project, Contractor, subcontractor and supplier, pertinent drawing and detail number, and specification section number, appropriate to submittal.
- D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.
- E. Schedule submittals to expedite Project and deliver to LANCER ASSOCIATES at 427 South College Avenue, Suite 103, Indianapolis, IN 46203. Coordinate submission of related items.
- F. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.
- G. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.
- H. Allow space on submittals for Contractor and Architect/Engineer review stamps.
- I. When revised for resubmission, identify changes made since previous submission.

- J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
- K. Submittals not requested will not be recognized or processed.
- L. Electronic File Drawings may be requested for submittals, the cost for each sheet is \$100.00 if requested in the Architect's current software edition. There will be an additional cost of \$25.00 per sheet for any other editions. In addition to this, a signed release of "Waiver of claims for use of electronic data" for each request for electronic files.

1.3 PRODUCT DATA

- A. Product Data: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents.

1.4 SHOP DRAWINGS

- A. Shop Drawings: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents.

1.5 SAMPLES

- A. Samples: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Samples For Selection as Specified in Product Sections:
 - 1. Submit to Architect/Engineer for aesthetic, color, or finish selection.

2. Submit samples of finishes from full range of manufacturers' standard colors, or in custom colors selected, textures, and patterns for Architect/Engineer selection.
- C. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- D. Include identification on each sample, with full Project information.
- E. Submit number of samples specified in individual specification sections; Architect/Engineer will retain one sample.
- F. Reviewed samples which may be used in the Work are indicated in individual specification sections.
- G. Samples will not be used for testing purposes unless specifically stated in specification section.
- H. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes.

1.6 TEST REPORTS

- A. Submit for Architect/Engineer's knowledge as contract administrator or for Owner.
- B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.7 CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Architect/Engineer, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product but must be acceptable to Architect/Engineer.

1.8 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Architect/Engineer for delivery to Owner in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.9 MANUFACTURER'S FIELD REPORTS

- A. Submit reports for Architect/Engineer's benefit as contract administrator or for Owner.
- B. Submit report in duplicate within 10 days of observation to Architect/Engineer for information.
- C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION 01 3300

**WAIVER OF CLAIMS
FOR USE OF ELECTRONIC DATA**

CONTRACT/JOB NO.: _____

PROJECT DESCRIPTION: _____

DATA BEING RELEASED: _____

DATE: _____

LANCER ASSOCIATES, INC., makes the above information available to you without payment/with nominal payment on condition that you agree that Lancer Associates, Inc. has developed the information for its own use and for the use of its clients and, therefore, makes no representation, warranties or undertakings of any type concerning the accuracy or completeness of the information or its usefulness in relation to your consulting services. By receipt and use of this data transmitted herewith, you agree to and do indemnify and hold harmless Lancer Associates, Inc. against and from any and all claims, damage, liability, and/or costs, including reasonable attorney's fees, made or asserted by you or by any third party allegedly resulting from your use or transfer to any other party of the data being provided to you herewith by Lancer Associates, Inc., including but not limited to any claimed inaccuracies or incompleteness of the data and regardless of whether such claims, etc., involve the alleged negligence of Lancer Associates, Inc. in the preparation, recording, or transfer of the data.

Lancer Associates, Inc.

BY: _____

TITLE: _____

No data are to be used unless and until an authorized representative of the recipient shall have properly executed and returned **"WAIVER OF CLAIMS FOR USE OF ELECTRONIC DATA"** form.

ACKNOWLEDGED AND ACCEPTED THIS _____ DAY OF _____, 20____.

COMPANY: _____

BY: _____

TITLE: _____

The electronic data transmitted herewith is for the use of the intended recipient. If you have intercepted or received this transmittal in error, you are not authorized to use or distribute the information contained herein by any means or for any purpose, and Lancer Associates, Inc. requests that you communicate the unintended receipt to Lancer Associates, Inc. as soon as possible, and Lancer Associates, Inc. will make arrangements to recover the data transmitted herewith.

ELECTRONIC FILE FEES

\$100.00 per sheet or

\$2000.00 per set

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Quality control and control of installation.
- B. Tolerances
- C. References.
- D. Mock-up requirements.
- E. Testing and inspection services.
- F. Manufacturers' field services.
- G. Examination.
- H. Preparation.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. When manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce required and specified quality.
- F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

- B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date for receiving bids, except where specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. When specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- E. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Architect/Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.5 MOCK-UP REQUIREMENTS

- A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be comparison standard for remaining Work.
- D. Where mock-up has been accepted by Architect/Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Architect/Engineer.

1.6 TESTING AND INSPECTION SERVICES

- A. The Contractor shall employ and pay for services of an independent testing agency or laboratory acceptable to Owner to perform specified testing.
 - 1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time Registered Professional Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.

QUALITY REQUIREMENTS

- B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by Architect/Engineer, Owner or Authority having jurisdiction.
 - 1. Laboratory: Authorized to operate at Project location.
 - 2. Laboratory Staff: Maintain full time registered Professional Engineer on staff to review services.
 - 3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.
- C. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by Architect/Engineer or Owner.
- D. Reports will be submitted by independent firm to Architect/Engineer and Contractor, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - 1. Notify Architect/Engineer and independent firm 24 hours prior to expected time for operations requiring services.
 - 2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
- F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by Architect/Engineer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.
- H. Agency Responsibilities:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Architect/Engineer and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Architect/Engineer and Contractor of observed irregularities or non-conformance of Work or products.
 - 6. Perform additional tests required by Architect/Engineer.
 - 7. Attend preconstruction meetings and progress meetings.

- I. Agency Reports: After each test, promptly submit two copies of report to Architect/Engineer and to Contractor. When requested by Architect/Engineer, provide interpretation of test results. Include the following:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Name of inspector.
 - 4. Date and time of sampling or inspection.
 - 5. Identification of product and specifications section.
 - 6. Location in Project.
 - 7. Type of inspection or test.
 - 8. Date of test.
 - 9. Results of tests.
 - 10. Conformance with Contract Documents.
- J. Limits On Testing Authority:
 - 1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency or laboratory may not approve or accept any portion of the Work.
 - 3. Agency or laboratory may not assume duties of Contractor.
 - 4. Agency or laboratory has no authority to stop the Work.

1.7 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect/Engineer 30 days in advance of required observations. Observer subject to approval of Architect/Engineer and Owner.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- D. Refer to Section 01 3300 - SUBMITTAL PROCEDURES, MANUFACTURERS' FIELD REPORTS article.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

END OF SECTION 01 4000

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities:

1. Temporary electricity.
2. Telephone service.
3. Internet service.
4. Temporary water service.
5. Temporary sanitary facilities.

B. Construction Facilities:

1. Vehicular access.
2. Parking.
3. Progress cleaning and waste removal.
4. Traffic regulation.

C. Temporary Controls:

1. Barriers.
2. Security.
3. Dust control.

D. Removal of utilities, facilities, and controls.

1.2 TEMPORARY ELECTRICITY

- A. Owner will pay cost of energy used. Exercise measures to conserve energy. Utilize Owner's existing power service.
- B. Provide temporary electric feeder from electrical service. Do not disrupt Owner's use of service.
- C. Complement existing power service capacity and characteristics as required for construction operations.
- D. Provide power outlets, with branch wiring and distribution boxes located as required for construction operations. Provide flexible power cords as required for portable construction tools and equipment.
- E. Provide main service disconnect and over-current protection at convenient location.
- F. Permanent convenience receptacles may be utilized during construction.
- G. Provide distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1. Provide 20 ampere duplex outlets, single phase circuits for power tools for every 500 sq ft of active work area.
2. Provide 20 ampere, single phase branch circuits for lighting.

1.3 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- B. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

1.4 TELEPHONE SERVICE

- A. Provide, maintain, and pay for cell phone service to field personnel at time of project mobilization.

1.5 EMAIL SERVICE

- A. Provide, maintain and pay for email service and dedicated telephone line to field office at time of project mobilization.

1.6 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of project mobilization.
- B. Environmental Control:
 1. Heating, Cooling, and Ventilating for Offices: Automatic equipment to maintain 68 degrees F heating and 72 degrees F cooling.
 2. Storage Spaces: Heating and ventilation as needed to maintain products in accordance with Contract Documents; lighting for maintenance and inspection of products.
- C. Storage Areas And Sheds: Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products.
- D. Maintenance And Cleaning:
 1. Weekly janitorial services for offices; periodic cleaning and maintenance for office and storage areas.
 2. Maintain approach walks free of mud, water, and snow.

1.7 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing spaces.

TEMPORARY FACILITIES AND CONTROLS

- C. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and rubbish from site weekly and dispose off-site.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.8 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas to allow for Owner's use of site, and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way and for public access to existing building.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
- E. Interior Enclosures:
 - 1. Provide temporary partitions to separate work areas from Owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, and to prevent damage to existing materials and equipment.
 - 2. Construction: Framing and [reinforced polyethylene] [plywood] [gypsum board] sheet materials with closed joints and sealed edges at intersections with existing surfaces:
 - a. Insulated to R 20.
 - b. STC rating of 35 in accordance with ASTM E90.
 - c. Maximum flame spread rating of 75 in accordance with ASTM E84.
 - 3. Paint surfaces exposed to view from Owner occupied areas.

1.9 SECURITY

- A. Security Program:
 - 1. Protect Work existing premises and Owner's operations from theft, vandalism, and unauthorized entry.
 - 2. Initiate program in coordination with Owner's existing security system at project mobilization.
 - 3. Maintain program throughout construction period until Owner occupancy.
- B. Entry Control:

1. Restrict entrance of persons and vehicles into Project site and existing facilities.
2. Allow entrance only to authorized persons with proper identification.
3. Maintain log of workers and visitors, make available to Owner on request.
4. Coordinate access of Owner's personnel to site in coordination with Owner's security forces.

C. Personnel Identification:

1. Provide identification badge to each person authorized to enter premises.
2. Badge To Include: Personal photograph, name and assigned number and expiration date and employer.
3. Maintain list of accredited persons, submit copy to Owner on request.
4. Require return of badges at expiration of their employment on the Work.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION 01 5000

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Products.
- B. Product delivery requirements.
- C. Product storage and handling requirements.
- D. Product options.
- E. Product substitution procedures.
- F. Equipment electrical characteristics and components.

1.2 PRODUCTS

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.
- C. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- D. For exterior storage of fabricated products, place on sloped supports above ground.

- E. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.

1.6 PRODUCT SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for Substitutions during bidding period to requirements specified in this section.
- B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that Contractor:
 - 1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
 - 2. Will provide same warranty for Substitution as for specified product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 - 5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.
- E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

F. Substitution Submittal Procedure:

1. Submit electronic copy of request for Substitution for consideration. Limit each request to one proposed Substitution.
2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
3. Architect/Engineer will notify Contractor in writing by addenda if accepted.

PART 2 PRODUCTS

2.1 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Include lugs for terminal box.
- B. Cord and Plug: Furnish minimum 6-foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

PART 3 EXECUTION

Not Used.

END OF SECTION 01 6000

SECTION 01 7000 - EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Closeout procedures.
- B. Final cleaning.
- C. Starting of systems.
- D. Demonstration and instructions.
- E. Protecting installed construction.
- F. Project record documents.
- G. Operation and maintenance data.
- H. Manual for materials and finishes.
- I. Manual for equipment and systems.
- J. Spare parts and maintenance products.
- K. Product warranties and product bonds.
- L. Maintenance service.

1.2 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.
- B. Provide submittals to Architect/Engineer required by authorities having jurisdiction.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

- C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
- D. Replace filters of operating equipment.
- E. Clean debris from roofs, gutters, downspouts, and drainage systems.
- F. Clean site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 STARTING OF SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect/Engineer and Owner seven days prior to start-up of each item.
- C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable manufacturer's representative and Contractors' personnel in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report in accordance with Section 01 33 00 that equipment or system has been properly installed and is functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. Demonstrate Project equipment by manufacturer's representative who is knowledgeable about the Project.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

EXECUTION REQUIREMENTS

- E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- G. Required instruction time for each item of equipment and system is specified in individual sections.

1.6 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

1.7 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work. Make electronic updates at 25%, 50%, 75% and 100%.:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following. Keep electronic copy up to date and submit at 25%, 50%, 75% and 100%.:
 - 1. Manufacturer's name and product model and number.

2. Product substitutions or alternates utilized.
 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Keep electronic copy each item to record actual construction including:
1. Measured depths of foundations in relation to finish first floor datum.
 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 4. Field changes of dimension and detail.
 5. Details not on original Contract drawings.
- G. Submit electronic As-built documents to Architect/Engineer at 25%, 50%, 75% and 100%.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit data bound in 8-1/2 x 11 inch (A4) text pages, three D side ring binders with durable plastic covers. Also submit electronic copies on flash drive.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages and electronic copies.
- E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

EXECUTION REQUIREMENTS

3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Originals of warranties and bonds.

1.9 MANUAL FOR MATERIALS AND FINISHES

- A. Submit two printed copies and one electronic copy of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.
- C. Submit one hard copy and one electronic copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.
- D. Submit two sets of hard copy and one electronic copy of revised final volumes in final form within 10 days after final inspection.
- E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.
- F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.
- H. Additional Requirements: As specified in individual product specification sections.
- I. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.10 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit two hard copies and one electronic copy of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

- C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.
- D. Submit two sets of revised final volumes in final form within 10 days after final inspection.
- E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- G. Include color coded wiring diagrams as installed.
- H. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.
- I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- J. Include servicing and lubrication schedule, and list of lubricants required.
- K. Include manufacturer's printed operation and maintenance instructions.
- L. Include sequence of operation by controls manufacturer.
- M. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- N. Include control diagrams by controls manufacturer as installed.
- O. Include Contractor's coordination drawings, with color coded piping diagrams as installed.
- P. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- R. Include test and balancing reports.
- S. Additional Requirements: As specified in individual product specification sections.

EXECUTION REQUIREMENTS

- T. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

1.11 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.
- B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.12 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information, and are notarized.
- D. Co-execute submittals when required.
- E. Include Table of Contents and assemble in three D side ring binder with durable plastic cover.
- F. Submit prior to final Application for Payment.
- G. Time Of Submittals:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
 - 2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.13 MAINTENANCE SERVICE

- A. Furnish service and maintenance of components indicated in specification sections.
- B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.

- D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION 01 7000

SECTION 02 4119 - SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolish and remove all items required to complete the work indicated.
2. Refer to all drawings for new work required. Demolish and remove any item required to make way for new work.
3. Demolish designated building equipment and fixtures.
4. Demolish designated construction.
5. Cutting and alterations for completion of the Work.
6. Removing designated items for reuse or Owner's retention as indicated.
7. Protecting items designated to remain.
8. Removing demolished materials.
9. Cap and identify existing utilities.
10. Provide adequate shoring and bracing.
11. Patching all substrates and finishes after demolition to match existing.

1.2 SUBMITTALS

- A. Division 01 - Submittal Procedures: Requirements for submittals.
- B. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.
- C. Shop Drawings:
 1. Indicate demolition and removal sequence.
 2. Indicate location of items designated for reuse or Owner's retention.
 3. Indicate location and construction of temporary work.

1.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition and subsurface obstructions.
- B. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

1.4 QUALITY ASSURANCE

- A. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.
- B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.
- C. Obtain required permits from authorities having jurisdiction.

1.5 PRE-INSTALLATION MEETINGS

- A. Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.6 SCHEDULING

- A. Schedule Work to coincide with new construction.
- B. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation and in adjoining spaces.
- C. Perform noisy or dusty work as scheduled with the Owner.
- D. Coordinate utility and building service interruptions with Owner.
 - 1. Do not disable or disrupt building fire or life safety systems without three days prior written notice to Owner.
 - 2. Schedule tie-ins to existing systems to minimize disruption.
 - 3. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.7 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PREPARATION

- A. Notify affected utility companies before starting work and comply with their requirements.
- B. Mark location and termination of utilities.
- C. Erect, and maintain temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public, Owner, and existing improvements indicated to remain.

SELECTIVE DEMOLITION

- D. Layout cuts in post tensioned concrete elements to avoid cutting concrete within 12 inches (300 mm) of any stressing tendon. Notify Architect/Engineer three days in advance of cutting post-tensioned concrete.
- E. Erect and maintain weatherproof closures for exterior openings.
- F. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.
- G. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.
- H. Provide appropriate temporary signage including signage for exit or building egress.
- I. Do not close or obstruct building egress path.
- J. Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.

3.2 SALVAGE REQUIREMENTS

- A. Coordinate with Owner to identify building components and equipment required to be removed and delivered to Owner.
- B. Tag components and equipment Owner designates for salvage.
- C. Protect designated salvage items from demolition operations until items can be removed.
- D. Carefully remove building components and equipment indicated to be salvaged.
- E. Disassemble as required to permit removal from building.
- F. Package small and loose parts to avoid loss.
- G. Mark equipment and packaged parts to permit identification and consolidation of components of each salvaged item.
- H. Prepare assembly instructions consistent with disassembled parts. Package assembly instructions in protective envelope and securely attach to each disassembled salvaged item.
- I. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

3.3 DEMOLITION

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Maintain protected egress from and access to adjacent existing buildings at all times.

- C. Do not close or obstruct roadways or sidewalks without permits.
- D. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer.
- E. Disconnect and remove designated utilities within demolition areas.
- F. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.
- G. Demolish in orderly and careful manner. Protect existing improvements and supporting structural members.
- H. Carefully remove building components indicated to be reused.
 - 1. Disassemble components as required to permit removal.
 - 2. Package small and loose parts to avoid loss.
 - 3. Mark components and packaged parts to permit reinstallation.
 - 4. Store components, protected from construction operations, until reinstalled.
- I. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- J. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- K. Remove temporary Work.
- L. After demolition, patch all substrates and finishes to match existing.

END OF SECTION 02 4119

SECTION 03 2000 – CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforcing bars.
2. Welded wire fabric.
3. Reinforcement accessories.

1.2 REFERENCE

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 530.1 - Specifications for Masonry Structures.
4. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:

1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
3. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
4. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
5. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
6. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
7. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

C. American Welding Society:

1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute:

1. CRSI - Manual of Standard Practice.
2. CRSI - Placing Reinforcing Bars.

1.3 SUBMITTALS

A. Section 01 3300 - Submittal procedures.

- B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.
 - 1. Where hooks are indicated on the Contract Drawings, provide standard hooks, unless otherwise noted.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI - Manual of Standard Practice, ACI 301, ACI 318.
- B. Prepare shop drawings in accordance with ACI SP-66.

1.5 QUALIFICATIONS

- A. Welders: AWS qualified within previous 12 months.

1.6 COORDINATION

- A. Administrative Requirements: Coordination and project conditions.
- B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcement: ASTM A615 60 ksi yield strength, steel bars, unfinished
- B. Deformed Wire: ASTM A496; unfinished.
- C. Plain- Steel Welded Wire Fabric: ASTM A185, fabricated from as -drawn steel wire into flat sheets.
- D. Concrete Reinforcing Fibers: ASTM C1116, high strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete. Tensile strength 130 ksi; toughness 15 ksi; 3/4 inch long fibers 34 million/lb fiber count.

2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.
- C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel Plastic tipped steel Stainless steel type; size and shape to meet Project conditions.

- D. Support the welded wire fabric over metal deck in any composite floor with 2 inch high continuous beam bolsters at 2'-0" o.c. maximum over the metal deck.

2.3 FABRICATION

- A. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice ACI SP-66 ACI 318 ASTM A184.
- B. Weld reinforcement in accordance with AWS D1.4.
- C. Located reinforcement splices not indicated on Drawings, at point of minimum stress. Review location of splices with Architect/Engineer.

PART 3 EXECUTION

3.1 PLACEMENT

- A. Place, support, and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
 - 1. Do not weld crossing reinforcement bars for assembly except as permitted by Architect/Engineer.
 - 2. Positively secure reinforcing to bar supports and tie or otherwise anchor bars to prevented displacement by construction loads or by the placing of concrete.
 - 3. Splice bars with a minimum lap of 40 bar diameters, unless otherwise indicated. Use mechanical splicers/couplers where quantity of reinforcement restricts placement of concrete if lapped splices are utilized.
- B. Do not displace or damage vapor retarder.
- C. Accommodate placement of formed openings.
- D. Space reinforcement bars with minimum clear spacing in accordance with ACI 318 of one bar diameter, but not less than 1 inch.
 - 1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.
- E. Maintain concrete cover around reinforcement in accordance with latest ACI 318.
- F. Bond and ground reinforcement in accordance with requirements of Section 16060.

3.2 ERECTION TOLERANCES

- A. Section 01400 - Tolerances.
- B. Install reinforcement within the following tolerances for flexural members, walls, and compression members:

Reinforcement Depth	Depth Tolerance	Concrete Cover Tolerance
Greater than 8 inches	plus or minus 3/8 inch	minus 3/8 inch
Less than 8 inches	plus or minus 1/2 inch	minus 1/2 inch

- C. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.

3.3 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements.
- B. Section 01 7000 - Field inspecting, testing, adjusting, and balancing.

3.4 INSPECTION

- A. Scheduling:
1. Notify the Architect/Engineer 24 hours in advance that reinforcing is in place and are ready for inspection. Keep Architect/Engineer informed of the basic schedule so that can anticipate inspection times in advance of the required 24-hour notice. Canceled pours are subject to additional inspection charges by the Architect/Engineer against the contractor where the Architect/Engineer representative is already in route to the site at the time the contractor pour is canceled. Inspection cost shall be base upon the hourly rate of the Architect/Engineer representative plus travel expenses.
 2. Do not cast concrete until the Architect/Engineer has observed and accepted the installation.

END OF SECTION 03 2000

SECTION 03 3000 – CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete for the following:
 - 1. Slabs on grade.
 - 2. Control, expansion and contraction joint devices.
 - 3. Other items indicated on the Drawings.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 305 - Hot Weather Concreting.
 - 3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
 - 4. ACI 308.1 - Standard Specification for Curing Concrete.
 - 5. ACI 318 - Building Code Requirements for Structural Concrete.
- B. ASTM International:
 - 1. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 2. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 4. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
 - 5. ASTM C150 - Standard Specification for Portland Cement.
 - 6. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
 - 7. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - 8. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - 9. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 - 10. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
 - 11. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
 - 12. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 - 13. ASTM C685/C685M - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
 - 14. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
 - 15. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

16. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
17. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
18. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
19. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
20. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
21. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
22. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
23. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
24. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
25. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
26. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
27. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal procedures.
- B. Product Data: Submit data on joint devices, attachment accessories, admixtures and joint systems.
- C. Design Data:
 1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
 - a. Hot and cold weather concrete work.
 - b. Air entrained concrete work.
 2. Identify mix ingredients and proportions, including admixtures.
 3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.
- D. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.
- E. Test Report:

1. Submit slump, air-entrainment, compressive strength and flatness and levelness test report to the Architect/Engineer.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Closeout procedures.
- B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.5 QUALITY ASSURANCE

- A. Codes and Standards:
 1. In addition to complying with all pertinent codes and regulations, comply with all Pertinent requirements of the following ACI Publications:
 - a. ACI 117 – Standard Specification for Tolerances for Concrete Construction and Materials.
 - b. ACI 211.1 –Standard Practice for Selecting Proportions for Normal, Heavy Weight, and Mass Concrete.
 - c. ACI 214 – Recommended Practice for Evaluation of Strength Test Results of Concrete.
 - d. ACI 305 – Recommended Practice for Hot Weather Concreting.
 - e. ACI 306 – Recommended Practice for Cold Weather Concreting.
 2. Where provisions of pertinent codes and standards conflict with this section of the Project Manual, the more stringent provisions shall govern.
- B. Qualification for Testing:
 1. The following field-testing procedures shall be performed only by personnel holding current certificates issued by the concrete Field Testing Technician.
 - a. Sampling of fresh concrete
 - b. Testing fresh concrete for slump
 - c. Testing fresh concrete for entrained air
 - d. Making concrete specimens for compression tests
- C. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to concrete work, including, but limited to, the following:
 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review requirements for concrete tolerances, finishing, and curing methods, prior to commencing concrete work.
 - a. Include floor covering installers, to review specific tolerance and finish requirements.

1.6 COORDINATION

- A. Section 01 3000 - Coordination and project conditions.
- B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather requirements: Do not allow concrete temperature to decrease below 50 degree F. Obtain approval prior to placing concrete when the ambient temperature is below 40 degree F or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 50 degree F minimum adjacent to both formwork and the structure while curing. Limit the rate of cooling to 5 degrees F in any 1 hour and 50 degrees F per 24 hours after heat application.
- B. Hot Weather requirements: Maintain required concrete temperature using Figure 1.a.5 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pounds of water per square foot of exposed concrete per hour. Use water reducing additives as allowed by mix designs and use super plastizer to increase workability at jobsite. Sprinkle or mist cool water on forms, steel and subgrade before placing, however, avoid standing water where have moistened. Unload concrete within 60-90 minutes of batching. Limit the addition of water at the job site. Add water only on arrival at the job site to adjust the slump. Water addition should not exceed about 2 to 2 ½ gallons per cubic yard. Adding water to concrete that is more than 1 ½ hours old should be avoided. Begin final finishing operation as soon as the water sheen has left the surface; start cuing as soon as finishing is completed. Continue curing for a least 3 days. Cover the concrete with wet burlap and plastic sheeting to prevent evaporation. Protect test cylinders by keeping them in a shaded area to prevent evaporation. Do not use accelerators to speed up the setting process.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal Portland type; manufactured by one manufacturer throughout the project.
- B. Fine and coarse Aggregates: ASTM C33.
 - 1. Class: Severe weathering region, but no less than 3S.
 - 2. Normal maximum aggregate size: one (1) inch for footing, foundation, slabs, curb and gutters.
 - 3. Norma maximum aggregate size: 3/4 inch for walls and structural framing.
- C. Water: Clean and not detrimental to concrete.

2.2 ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Chemical: ASTM C494
 - 1. Type A – Water Reducing
 - a. Contain not more than 0.1% chloride ions, by weight of cement.
 - b. Subject to compliance with requirements, provide one of the following products:
Eucon WR-75; Euclid Chemical Co.
Pozsolith 344 or 122 N; Master Builders.
Plastocrete 160; Sika Chemical Corp.
Chemtard; Chem-Masters Crop.
Daracem 55; W.R. Grace
Catexol 1000N; Solvay Construction Materials, Inc.
Or approved equal.
 - 2. Type F – Water Reducing, High Range or Type G – Water Reducing, High Range and Retarding
 - a. Contain not more than 0.1% chloride ions, by weight of cement.
 - b. Subject to compliance with requirements, provide one of the following products:
Daracem 100; W.R. Grace.
PSP; Protex Industries, Inc.
Super P; Anti-Hydro.
Sikament; Sika Chemical Corp.
Mighty 150; Euclid Chemical Co.
PSI Super; Gifford-Hill.
Pozzolith 400; Master Builders.
Catexol 1000 SP-MN; Solvay Constr. Materials, Inc.
Or approved equal.
 - 3. Type E – Water Reducing and Accelerating or Type C Accelerating
 - a. Contain not more than 0.1% chloride ions, by weight of cement; shall be used only with the Architect's approval.
 - b. Subject to compliance with requirements, provide one of the following products:
Accelguard 80; Euclid chemical Co.
Pozzalith 500; Master Builders.
Polarset; W. R. Grace.
Or approved equal.
 - 4. Type D – Water Reducing and Retarding
 - a. Contain not more than 0.1% chloride ions, by weight of cement.
 - b. Subject to compliance with requirements, provide one of the following products:
Edoco 20006; Edoco Technical Products.
Pozzolith 300-R or 122R; Master Builders.
Eucon Retarder 75; Euclid chemical Co.
Daratard-17; W. R. Grace
Plastiment; Sika Chemical Co.
Or approved equal.

- C. Fly Ash: ASTM C618 Class C or F.
 - 1. Fly Ash shall not replace more than 15% of the cement.
 - 2. Fly Ash shall not be used in concrete used for flatwork.

2.3 ACCESSORIES

- A. Bonding Agent: Polyvinyl Acetate or acrylic base, rewettable type (cosmetic repairs).
 - 1. Subject to compliance with requirements, provide one of the following products:
 - J-40 bonding Agent; Dayton Superior Corp.
 - Weldcrete; Larsen Products.
 - Everbond; L & M Construction Chemicals.
 - EucoWeld; Euclid Chemical Co.
 - Hornweld; A.C. Horn.
 - Sonocrete; Sonneborn-Contech.
 - Acrylic Bondcrete; The Burke Co.
 - Or approved equal.
- B. Vapor Retarder must have all of the following qualities:
 - 1. Permeance of less than 0.01 Perm [grains/(sqft- hr- inHg)] as tested in accordance with ASTM E 1745 Section 7.
 - 2. Other performance criteria:
 - a. Strength: ASTM E 1745 Class A.
 - b. Thickness: 15 mils minimum
 - 3. Vapor Retarder Products:
 - a. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC.
- C. Vapor Barrier: 10-mil-minimum thick, semiflexible, seven-ply sheet membrane consisting of reinforced core and carrier sheet with fortified asphalt layers, protective weathercoating, and removable plastic release liner. Furnish manufacturer's accessories including bonding asphalt, pointing mastics, and self-adhering joint tape.
 - 1. Water-Vapor Permeance: 0.00 grains/h x sq. ft. x inches Hg; ASTM E154.
 - 2. Tensile Strength: 140 lbf/in; ASTM E154.
 - 3. Puncture Resistance: 90 lbf; ASTM E154.
 - 4. Location: Under gym floor.
- D. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.4 GRANULAR FILL

- A. Granular fill: Clean mixture of crushed stone or crushed gravel; conforming to INDOT Specification for #8 coarse aggregate.

CAST-IN-PLACE CONCRETE

2.5 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler Type A: ASTM D1751 Asphalt impregnated fiberboard or felt, 1/4 inch thick; tongue and groove profile.
- B. Construction Joint Devices: Integral extruded plastic formed to tongue and groove profile, with removable top strip exposing sealant trough,] knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.
- C. Expansion and Contraction Joint Devices: ASTM B221 alloy, extruded aluminum; resilient elastomeric filler strip with Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery; extruded aluminum of longest manufactured length at each location, recessed mounted; color as selected.
- D. Sealant and Primer: As specified in Section 07900.

2.6 CONCRETE MIX

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
 - 2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.
- B. Submit written report to Architect/Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect/Engineer.
- C. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- D. Trench footings, column footings, wall footings, grade beams and other Structural Concrete: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 3000 psi.
 - 2. Maximum Slump: 4 inches
 - 3. Minimum Cementitious Content: 517 pounds per cubic yard.
 - 4. Coarse aggregate: Any locally available aggregate meeting ASTM C33.
 - 5. Maximum Slump for concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2-to 4-inch slump.
 - 6. Water-Cement Ratio (non-air-entrained): 0.46 Maximum.
 - 7. Water-Cement Ratio (air-entrained) 0.40 Maximum.
- E. Interior Slabs on Grade: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 4000 psi.

2. Minimum Cement Content: 564 lb/cu.yd.
 3. Slump: 6 inches +/- 1 inch rough the required use of either a Mid-Range or High-range Water-Reducing Admixture.
 4. Coarse aggregate: Any locally available aggregate meeting ASTM C33.
 5. Maximum Slump for Pump-Mix Concrete Containing High-Range Water-Reducing admixture: 8 inches after admixture is added to concrete with 2- to 4- inch slump.
 6. Water-Cement Ratio (non-air-entrained): 0.40 maximum.
- F. Exterior Concrete: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28Days): 4000 psi
 2. Minimum Cementitious Materials Content: 564 lb/cu.yd.
 3. Maximum Slump: 4 inches
 4. Coarse aggregate: Crushed limestone aggregate meeting ASTM C33.
 5. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2-to 4-inch slump.
 6. Water-Cement Ratio (non-air-entrained): 0.46 maximum.
 7. Water-Cement Ratio (air-entrained): 0.40 maximum.
- G. Interior Elevated Slabs: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 days): 4000 psi.
 2. Minimum Cement content: 564 lb/cu.yd.
 3. Maximum Slump: 4 inches.
 4. Coarse aggregate: Any locally available aggregate meeting ASTM C33.
 5. Maximum Slump for Concrete Containing High-Range Water-Reducing admixture: 8 inches after admixture is added to concrete with 2-to 4- inch slump.
 6. Water-Cement Ratio (non-air-entrained): 0.46 maximum.
 7. Water-Cement Ratio (air-entrained): 0.40 maximum.
- H. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 requirements.
- I. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
1. Fly Ash: 15 percent.
- J. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete exposed to deicers or subject to freezing and thawing while moist.
- K. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:
1. Air Content: 5.5 percent for 1-1/2 inch- normal maximum aggregate size.
 2. Air Content: 6 percent for 1 inch-normal maximum aggregate size.

- 3. Air Content: 6 percent for 3/4 inch-normal maximum aggregate size.
- L. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.
- M. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- N. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) 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 concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
- O. Concrete Mixes:
 - 1. Ready-Mix Concrete: Comply with requirements of ASTM C94, and herein specified.
 - 2. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.
 - a. When air temperature is between 85 degrees F (30 degree C) and 90 degrees F (32 degrees C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes.
 - b. When air temperature is above 90 degrees F (32 degree C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Coordination and project conditions.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.
- B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

- C. Remove debris and ice from formwork, reinforcement, and concrete substrates.
- D. Remove water from areas receiving concrete before concrete is placed.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301 ACI 318.
- B. Notify Architect/Engineer minimum 24 hours prior to commencement of operations.
- C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and are not disturbed during concrete placement.
- D. Install vapor retarder under interior slabs on grade in accordance with ASTM E1643. Lap joints minimum 6 inches and seal watertight by taping edges and ends.
- E. Repair vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.
- F. Install vapor barrier under gym floor.
- G. Separate slabs on grade from vertical surfaces with 1/2-inch-thick joint filler.
- H. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- I. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface. Conform to Section 07 9000 for finish joint sealer requirements.
- J. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- K. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.
- L. Install joint covers in longest practical length, when adjacent construction activity is complete.
- M. Apply sealants in joint devices in accordance with Section 07 9000.
- N. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- O. Place concrete in continuously between predetermined expansion, control, and construction joints.
- P. Do not interrupt successive placement; do not permit cold joints to occur.

- Q. Place floor slabs in checkerboard or saw cut pattern indicated.
- R. Saw cut joints within 12 hours after placing. Use 3/16-inch-thick blade, cut into 1/4 depth of slab thickness.
- S. Screed floors and slabs on grade] level, maintaining surface flatness of maximum 1/4 inch in 10 ft.

3.4 CONCRETE FINISHING

- A. Provide formed concrete surfaces to be left exposed concrete walls columns beams joists with smooth rubbed finish.
- B. Finish concrete floor surfaces to requirements of Section 03 3500.
- C. Finish concrete floor surfaces in accordance with ACI 301.
- D. Wood float surfaces receiving quarry tile, ceramic tile, or terrazzo with full bed setting system.
- E. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin set quarry tile and thin set ceramic tile.
- F. Steel trowel surfaces which are indicated to be exposed.
- G. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/8 inch per foot nominal as indicated on drawings.

3.5 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
 - 1. Protect concrete footings from freezing.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Cure concrete in accordance with ACI 308.

3.6 FIELD QUALITY CONTROL

- A. Section 01 4000 – Quality Requirements, 01 7000 - Field inspecting, testing, adjusting, and balancing.
- B. Field inspection and testing will be performed in accordance with ACI 301 and under provisions of Section 01 4000. Quality requirements by an ACI certified technician.
- C. Provide free access to Work and cooperate with appointed firm.

- D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
- E. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
- F. Four concrete test cylinders will be taken for every 75 less cubic yards of each class of concrete placed.
- G. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.
- H. One slump test will be taken for each set of test cylinders taken.
- I. One air content test will be made for each set of test cylinders taken.
- J. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.7 PATCHING

- A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.
- C. Patch imperfections [as directed by Architect/Engineer] [in accordance with ACI 301.

3.8 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by Architect/Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

3.9 SCHEDULE - CONCRETE TYPES AND FINISHES

- A. Foundation Walls: 4,000 psi 28 day concrete, form finish with honeycomb filled surface.
- B. Underside of Supported Floors and Structure Exposed to View: 4,000 psi (28 MPa) 28 day concrete, sack rubbed finish.
- C. Exposed Portico Structure: 4,000 psi (28 MPa) 28 day concrete, air entrained, smooth stone rubbed finish.

D. Finish of Formed Surfaces

1. Rough Form Finish: for formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.
2. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.
3. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaces, which have received smooth form finish treatment, not later than one day after form removal.
 - a. Moisture concrete surfaces and rub with caraborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.
4. Grout Cleaned Finish: Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment.
 - a. Combine one part Portland cement to 1-1/2 parts fine sand by volume and mix with water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will match adjacent surfaces.
 - b. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
4. Related Unformed Surfaces: At tops of wall, horizontal offsets, and similar unformed surfaces occurring 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.

E. Monolithic Slab Finishes

1. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.
 - a. After placing slabs, plane surface so that depressions between high spots do not exceed 1/2" under a 10' straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms or rakes.
2. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

- a. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane so that depressions between high spots do not exceed 5/16" under a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
3. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system.
 - a. After floating, begin first trowel finish operation using a power driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface plane so that depressions between high spots do not exceed 1/8" under a 10' straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.
4. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.
5. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
6. Non-Slip Aggregate Finish: Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, sloped walks and elsewhere as indicated.
 - a. After completion of float finishing, and before starting trowel finish, uniformly spread 25 lbs. of dampened non-slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.
 - b. After curing, lightly work surface with a steel wire brush, or an abrasive stone and water to expose non-slip aggregate.

END OF SECTION 03 3000

SECTION 03 3900 – CONCRETE CURING AND SEALING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes initial and final curing of horizontal and vertical concrete surfaces.
- B. Section includes sealing exposed floors.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.
 - 3. ACI 308.1 - Standard Specification for Curing Concrete.
 - 4. ACI 318 - Building Code Requirements for Structural Concrete.
- B. ASTM International:
 - 1. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
 - 2. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 3. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - 4. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.

1.3 SUBMITTALS

- A. Division 01 Submittal procedures.
- B. Product Data: Submit data on curing compounds, mats, paper, film, compatibilities, and limitations.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 ACI 302.1 ACI 318.
- B. Perform work in accordance with applicable requirements of governing authorities have jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Deliver curing materials in manufacturer's packaging including application instructions.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Membrane Curing Compound: ASTM C309, Type1, Class B resin type, clear without fugitive dye.
 - 1. Manufacturers:
 - a. Masterseal; Master Builders.
 - b. Ecocure; Euclid Chemical Co.
 - c. Spartan-Cote; The Burke Co.
 - d. LR-152; Protex Industries
 - e. Sealtight 1300 clear; W. R. Meadows
 - f. CS-309; W. R. Meadows
 - g. Or Approved Equal.
- B. Polyethylene Film: ASTM C171, ASTM D2103, 6 mil thick, clear.
- C. Water: Potable, not detrimental to concrete.

2.2 SEALERS FOR EXPOSED CONCRETE FLOORS

- A. Acceptable Products: Subject to compliance with requirements, provide one of the following:
 - 1. Clear, Waterborne, Membrane-Forming Sealing Compound:
 - a. Klear-Lote Cure-Sealer-Hardener, 30 percent solids; Burke by Edoco.
 - b. Polyseal WB; ChemMasters.
 - c. UV Safe Seal; Lambert Corporation.
 - d. Lumiseal WB Plus; L & M Construction Chemicals, Inc.
 - e. Vocomp-30; W. R. Meadows, Inc.
 - f. Metcure 30; Metalcrete Industries.
 - g. Or Equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces are ready to be cured.

3.2 INSTALLATION - HORIZONTAL SURFACES

- A. Cure concrete in accordance with ACI 308.
- B. Membrane Curing Compound: Apply curing compound in two coats with second coat applied at right angles to first or in accordance with manufacturer's instructions or use water cure method: Cover newly finished concrete with a vapor barrier type material and keep wet with water for a period of days until concrete has attained 70% of design strength.

CONCRETE CURING AND SEALING

3.3 INSTALLATION - VERTICAL SURFACES

- A. Cure concrete in accordance with ACI 308.
- B. Spraying: Spray water over surfaces and maintain wet for 7 days or use membrane curing compound: Apply compound in two coats with second coat applied at right angle to first. Or in accordance with manufacturer's instruction.

3.4 INSTALLATION OF SEALER

- A. Follow the manufacturer's recommendations.

3.5 PROTECTION OF FINISHED WORK

- A. Division 01 - Execution Requirements: Protecting finished Work.
- B. Do not permit traffic over unprotected floor surface.

END OF SECTION 03 3900

SECTION 04 0120 – MASONRY CLEANING

PART 1 – GENERAL

1.01 SUMMARY

A. Includes, but not limited to:

1. Cleaning masonry.

1.02 REFERENCES

A. Definitions:

1. Cold Weather, for cleaning purposes, refers to the surface temperature at or below 40° F (4° C) and is expected to remain below for a period of (7) days after cleaning.
2. Hot Weather, for cleaning purposes, refers to the surface temperature at or above 90° F (32° C).
3. Low Pressure Spray: Under 100 P.S.I. (Pounds per Square Inch)
4. High Pressure Spray: Above 800 P.S.I. (Pounds per Square Inch)

1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-testing: testing of cleaning material on all applicable substrates should be conducted prior to full scale cleaning.

1.04 SUBMITTALS

A. Manufacturers Documentation

1. Product Data and MSDS for each product submitted;
2. Supporting information, i.e. literature as requested.

1.05 QUALITY ASSURANCE

A. Testing

1. For the re-pointing material, clean a mock-up panel or clean an indiscreet area.
2. For each type of stain, clean a 2' x 2' section in an indiscreet area.
3. For each type of coating surface, strip a 2' x 2' section in an indiscreet area.
4. Allow test area to completely dry prior to evaluating cleaning results.
5. Do not proceed with full scale cleaning until Architect has accepted the cleaning results.

1.06 DELIVERY, HANDLING AND STORAGE

A. Storage and Handling Requirements

1. Chemicals may be stored in cold weather temperatures, but should be brought up to 40° F or higher prior to usage.
2. Chemicals should be handled according to manufacturers' safety procedures.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Mortar Removal Materials

1. Acid-Based Cleaner: Manufacturers' standard acidic new masonry cleaner composed of buffered hydrochloric acid
 - a. EaCo Chem, Inc.: NMD 80
2. Non-Hydrochloric Acid Based Cleaner: Manufacturers' standard non-hydrochloric acidic new masonry cleaner composed of organic salts
 - a. EaCo Chem, Inc.: SOS 50

B. Calcium-Based Stain Removal Materials

1. Water Soluble Salts (efflorescence) Remover: Manufacturers' proprietary cleaner designed to remove calcium chloride (efflorescence) and help prevent its return.
 - a. EaCo Chem, Inc.: EF-Fortless
 - b. EaCo Chem, Inc.: NMD 80
2. Calcium Carbonate (calcite) Remover: Manufacturers' proprietary two-step system designed to remove calcium carbonate (calcite) deposits.
 - a. EaCo Chem, Inc.: Calcite Presoak followed by NMD 80
 - b. EaCo Chem, Inc.: Calcite Presoak GEL followed by NMD 80
3. Calcium Silicate (white scum) Remover: Manufacturers' proprietary two-step system designed to remove calcium silicate (white scum) deposits.
 - a. EaCo Chem, Inc.: White Scum Presoak followed by NMD 80

C. Restoration - Non-Calcium Based Stain Removal Materials

1. Acid-Based Cleaner: Manufacturers' non-regulated acidic restoration cleaner composed of hydrochloric acid blended with other acids, detergents, wetting agents and inhibitors.
 - a. EaCo Chem, Inc.: OneRestore
2. Gelled Acid-Based Cleaner: Manufacturers' standard gelled acidic restoration cleaner composed of hydrochloric acid blended with other acids, detergents, wetting agents and inhibitors.

b. EaCo Chem, Inc.: OneRestore GEL

3. Ammonium Bifluoride-Based Cleaner: Manufacturers' standard acidic restoration cleaner composed of ammonium bifluoride blended with other acids, detergents, wetting agents and inhibitors.

a. EaCo Chem, Inc.: GS Restoration

D. Coating Removal Materials

1. Alkaline-Based Coating Remover: Manufacturers' standard alkaline-based formulation for removing coatings from limestone.

a. EaCo Chem, Inc.: LCS

2. Solvent-Based Coating Remover: Manufacturers' standard solvent formulation for removing coatings from brick and terra cotta.

a. EaCo Chem, Inc.: AcryliStrip

b. EaCo Chem, Inc.: Graf-Ex

3. Low Odor Solvent-Based Coating Remover: Manufacturers' standard solvent formulation for removing coatings from brick and terra cotta.

a. EaCo Chem, Inc.: Stripsol LO

4. Paste Alkaline-Based Coating Remover: Manufacturers standard paste alkaline formulation for removing multiple layers of coatings from limestone.

a. EaCo Chem, Inc.: Stripper Cream

5. Paste Solvent-Based Coating Remover: Manufacturers standard paste solvent formulation for removing multiple layers of coatings from limestone.

a. EaCo Chem, Inc.: InStrip

2.02 MANUFACTURER

- A. Mortar removal cleaner manufacturer contact information: EaCo Chem, Inc.; 765 Commerce Ave, New Castle, PA 16101 – Phone: 800-313-8505, Fax: 724-656-0757 – info@eacochem.com – www.eacochem.com
- B. Calcium-based stain remover manufacturer contact information: EaCo Chem, Inc.; 765 Commerce Ave, New Castle, PA 16101 – Phone: 800-313-8505, Fax: 724-656-0757 – info@eacochem.com – www.eacochem.com
- C. Restoration - Non-calcium based cleaner manufacturer contact information: EaCo Chem, Inc.; 765 Commerce Ave, New Castle, PA 16101 – Phone: 800-313-8505, Fax: 724-656-0757 – info@eacochem.com – www.eacochem.com

- D. Coating remover manufacturer contact information: EaCo Chem, Inc.; 765 Commerce Ave, New Castle, PA 16101 – Phone: 800-313-8505, Fax: 724-656-0757 – info@eacochem.com – www.eacochem.com

PART 3 – EXECUTION

3.01 RESTORATION CLEANING SPECIALIST

- A. Restoration Cleaning Specialist Firms with at least 5 years documented experience.

3.02 PROTECTION

- A. Protect adjacent and surrounding surfaces not intended to be cleaned from exposure to the cleaning chemical to prevent damage.
- B. Prevent cleaning chemical from coming into contact with people, motor vehicles, landscaping and other building materials that could be harmed by such contact.
- C. Follow chemical cleaner and chemical remover manufacturers' recommendations for personal protection. Always read product spec sheets for personal protection.

3.03 MORTAR REMOVAL

- A. Pre-wet (do not saturate) or flash cool the surface with water.
- B. Apply acid-based or non-acid based new masonry material in accordance to manufacturers' instructions based on pre-tested and pre-approved areas.
1. Use a chemical resistant sprayer to apply the restoration material evenly over the entire surface.
 2. Do not allow new masonry material to dry on the brick or terra cotta surface or any adjacent surface.
 3. Rinse the new masonry material thoroughly from the surface. Continue the rinse to the lower levels so no chemical dries on lower levels.

3.04 CALCIUM-BASED STAIN REMOVAL

- A. Water Soluble Salts (efflorescence) Removal:
1. Apply proprietary cleaner in accordance to manufacturers' instructions based on pre-tested and pre-approved area.
 - a. Use an acid resistant sprayer to apply cleaner evenly over the affected areas.
 - b. The product will foam upon contact with the stains. When the foaming ceases; apply another application to the affected areas. Continue re-applying until there is no more foam on contact.
 - c. Rinse material according to product instructions.
 - d. Clean the rest of the wall as necessary.

B. Calcium Carbonate (calcite) Removal:

1. Apply proprietary two-step system in accordance to manufacturers' instructions based on pre-tested and pre-approved area.
 - a. Use an acid resistant sprayer to apply the first step evenly over the affected areas. Rinse the runoff before it can set on un-affected areas.
 - b. The product will foam upon contact. Allow to dwell for a pre-determined time. Repeat until a scratch test shows the calcite has been softened.
 - c. Use an acid resistant sprayer to apply the second step evenly over the affected areas.
 - d. Rinse material according to product instructions.
 - e. Repeat above steps as necessary.
 - f. Clean the rest of the wall as necessary.

C. Calcium Silicate (white scum) Removal:

1. Apply proprietary two-step system in accordance to manufacturers' instructions based on pre-tested and pre-approved area.
 - a. Use an acid resistant sprayer to apply the first step evenly over the affected areas. Rinse the runoff before it can set on un-affected areas.
 - b. The product will foam upon contact. Allow to dwell for a pre-determined time.
 - c. Use an acid resistant sprayer to apply the second step evenly over the affected areas.
 - d. Rinse material according to product instructions.
 - e. Repeat above steps as necessary.
 - f. Clean the rest of the wall as necessary.

3.05 RESTORATION - NON-CALCIUM BASED STAIN REMOVAL**A. Stain removal with acid-based or gelled acid-based restoration material:**

1. Pre-wet (do not saturate) or flash cool the surface with clean water.
2. Apply acid-based and/or gelled acid-based restoration material in accordance to manufacturers' instructions based on pre-tested and pre-approved areas.
 - a. Use an acid resistant sprayer to apply the restoration material evenly over the entire surface.
 - b. Do not allow the restoration material to dry on the surface or any adjacent surface.
 - c. Rinse the restoration material thoroughly from the surface. Continue the rinse to the lower levels to prevent soil or material from setting on those levels.

B. Stain removal with ammonium bifluoride-based restoration material:

1. Pre-wet (do not saturate) or flash cool the surface with clean water.
2. Apply ammonium bifluoride-based restoration material in accordance to manufacturers' instructions based on pre-tested and pre-approved areas.
 - a. Use an acid resistant sprayer to apply the restoration material over the intended surface.
 - b. Do not allow the restoration material to dry on the surface or any adjacent surface. Keep the restoration material off of any surface not suitable for this type of material.
 - c. Rinse the restoration material thoroughly from the surface. Continue the rinse to the lower levels to prevent soil or material from setting on those levels.

3.06 COATING REMOVAL

A. Coating removal with alkaline-based coating remover:

1. Use a caustic resistant sprayer to apply coating remover to a dry surface.
2. Allow coating remover to sit on the surface for a period of time determined in pre-tested and pre-approved area.
3. Rinse coating remover and removed coating from the surface using high pressure. Continue the rinse to the lower levels to prevent coating from setting on those levels.
 - a. Dispose of coating waste in accordance to local regulations.
4. Apply acid-based, gelled acid-based or ammonium bifluoride-based restoration material if needed in accordance to manufacturers' instructions based on pre-tested and pre-approved areas.
 - b. Do not allow restoration material to dry on the surface or any adjacent surface.
 - c. Rinse the restoration material thoroughly from the surface. Continue the rinse to the lower levels to prevent soil or material from setting on those levels.

B. Coating removal with solvent-based coating remover:

1. Use a solvent compatible sprayer to apply the coating remover to a dry surface.
2. Allow coating remover to sit on the surface for a period of time determined in pre-testing and pre-approved areas.
3. Rinse coating remover and loosened coating from the surface using high pressure. Continue the rinse to the lower levels to prevent coating from setting on those levels.
 - a. Dispose of coating waste in accordance to local regulations.

4. Apply acid-based, gelled acid-based or ammonium bifluoride-based restoration material if needed in accordance to manufacturers' instructions based on pre-tested and pre-approved areas.
 - a. Do not allow restoration material to dry on the surface or any adjacent surfaces.
 - b. Rinse the restoration material thoroughly from the surface. Continue the rinse to the lower levels to prevent soil or material from setting on those levels.

C. Coating removal with paste alkaline-based coating remover.

1. Use a caustic compatible sprayer or roller to apply the coating remover to a dry surface.
2. Allow coating remover to sit on the surface for a period of time determined in pre-testing and pre-approved areas.
3. Rinse coating remover and loosened coating from the surface using low pressure first to collect coating residue at the base of the wall. Follow with a high pressure rinse to remove remaining coating from the wall. Continue the rinse to the lower levels to prevent coating from setting on those levels.
 - a. Dispose of coating waste in accordance to local regulations.
4. Apply acid-based, gelled acid-based or ammonium bifluoride-based restoration material if needed in accordance to manufacturers' instructions based on pre-tested and pre-approved areas.
 - a. Do not allow restoration material to dry on the surface or any adjacent surfaces.
 - b. Rinse the restoration material thoroughly from the surface. Continue the rinse to the lower levels to prevent soil or material from setting on those levels.

D. Coating removal with paste solvent-based coating remover.

1. Use a solvent compatible roller or brush to apply the coating remover to a dry surface.
2. Allow coating remover to sit on the surface for a period of time determined in pre-testing and pre-approved areas.
3. Rinse coating remover and loosened coating from the surface using low pressure first to collect coating residue at the base of the wall. Follow with a high pressure rinse to remove remaining coating from the wall. Continue the rinse to the lower levels to prevent coating from setting on those levels.
 - a. Dispose of coating waste in accordance to local regulations.
4. Apply acid-based, gelled acid-based or ammonium bifluoride-based restoration material if needed in accordance to manufacturers' instructions based on pre-tested and pre-approved areas.

- a. Do not allow restoration material to dry on the surface or any adjacent surfaces.
- b. Rinse the restoration material thoroughly from the surface. Continue the rinse to the lower levels to prevent soil or material from setting on those levels.

3.07 FINAL CLEANING

- A. Clean site of all unused cleaning material, residues, rinse water, wastes and protection material in accordance with federal and local environmental regulations.

END OF SECTION 04 0120

SECTION 04 0513 – MASONRY MORTAR AND GROUT

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes mortar and grout for masonry.

1.2 REFERENCES

- A. American Society for Testing and Materials:

1. ASTM C91 - Standard Specification for Masonry Cement.
2. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
3. ASTM C150 - Standard Specification for Portland Cement.
4. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
5. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
6. ASTM C387 - Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
7. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
8. ASTM C476 - Standard Specification for Grout for Masonry.
9. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
10. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
11. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
12. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry.
13. ASTM C1314 - Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry.
14. ASTM C1329 - Standard Specification for Mortar Cement.
15. ASTM C1357 - Standard Test Method for Evaluating Masonry Bond Strength.

- B. The Masonry Society:

1. TMS MSJC - Building Code for Masonry Structures (ACI 530/ASCE 5/TMS 402), Specification for Masonry Structures (ACI 530.1/ASCE 6/TMS 602) and Commentaries.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal requirements.
- B. Samples: Submit two samples of mortar, illustrating mortar color and color range.
- C. Design Data: Submit design mix when Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.

D. Test Reports:

1. Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270 or mortar to requirements of ASTM and test and evaluation reports to ASTM C780 for aggregate ratio and water content, air content, consistency and compressive strength.
2. Submit reports on grout indicating conformance of grout to property requirements of ASTM and test and evaluation reports to ASTM C1019.

E. Manufacturer's Installation Instructions: Submit premix mortar manufacturer's installation instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with TMS MSJC Code and TMS MSJC Specification.

B. Maintain one copy of each document on site.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 6000 - Product Requirements.

B. Hot and Cold Weather Requirements: TMS MSJC Specification.

PART 2 PRODUCTS

2.1 MORTAR AND MASONRY GROUT

A. Manufacturers:

1. Blue Circle Cement.
2. Citadel Cement.
3. CTS Cement Manufacturing Co.
4. Lehigh Portland Cement.
5. Medusa Cement Co.
6. The Quikrete Companies.
7. Solomon Colors.
8. Southern Grouts and Mortars.

2.2 COMPONENTS

A. Portland Cement: ASTM C150, Type I.

B. Masonry Cement: ASTM C91, Type S, gray color.

C. Mortar Cement: ASTM C1329, Types S, gray color.

MASONRY MORTAR AND GROUT

- D. Premix Mortar: ASTM C387, Type S, using gray color cement.
- E. Mortar Aggregate: ASTM C144, standard masonry type.
- F. Hydrated Lime: ASTM C207, Type S.
- G. Grout Aggregate: ASTM C404, fine and coarse.
- H. Water: Clean and potable.
- I. Mortar Color: Mineral oxide pigment; color as selected by the Architect.
- J. Cold Weather Admixture: Accelguard 80 by Euclid or Trimix-NCA Sonneborn Div. Of ChemRex.
- K. Water Repellent Admixture: Dry-block by W.R. Grace or Rheopel by Master Builders.
- L. Calcium chloride is not permitted.

2.3 MIXES

- A. Mortar Mixes:
 - 1. Use ASTM C270, Type S, for reinforced masonry and where indicated.
- B. Mortar Mixing:
 - 1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
 - 2. Achieve uniformly damp sand immediately before mixing process.
 - 3. Add mortar color and admixtures to achieve uniformity of mix and coloration.
 - 4. Re-temper only within two hours of mixing.
- C. Grout Mixes:
 - 1. Grout for Non-Structural Masonry: 3,000 psi strength at 28 days; 8-11 inches slump; mixed in accordance with ASTM C476 Coarse or Fine grout.
 - 2. Grout for Structural Masonry: 3,000 psi strength at 28 days; 8-11 inches slump; mixed in accordance with ASTM C476 Coarse or Fine grout.
 - 3. Application:
 - a. Coarse Grout: For grouting spaces with minimum 4 inches dimension in every direction.
 - b. Fine Grout: For grouting other spaces.
- D. Grout Mixing:
 - 1. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.
 - 2. Add admixtures; mix uniformly.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Administrative Requirements: Coordination and project conditions.
- B. Request inspection of spaces to be grouted.

3.2 INSTALLATION

- A. Install mortar and grout in accordance with TMS MSJC Specification.

3.3 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Testing and Inspection Services.
- B. Testing of Mortar Mix: In accordance with ASTM C780 for aggregate ratio and water content, air content, consistency, and compressive strength.
- C. Testing of Grout Mix: In accordance with ASTM C1019 for compressive strength, and in accordance with ASTM C143/C143M for slump.

END OF SECTION 04 0513

SECTION 04 2100 – UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes concrete masonry units; reinforcement, anchorage, and accessories.

1.2 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM A153/A153M - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 3. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 4. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 5. ASTM A951 - Standard Specification for Masonry Joint Reinforcement.
 - 6. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
 - 7. ASTM C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units.
 - 8. ASTM C212 - Standard Specification for Structural Clay Facing Tile.
- B. The Masonry Society:
 - 1. TMS MSJC - Building Code for Masonry Structures (ACI 530/ASCE 5/TMS 402), Specification for Masonry Structures (ACI 530.1/ASCE 6/TMS 602) and Commentaries.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following net-area compressive strength (f'_m) at 28 days. Determine compressive strength on masonry by testing masonry prisms according to ASTM C1314.
 - 1. For Concrete Unit Masonry: $f'_m = 2000$ p.s.i.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal requirements.
- B. Product Data: Submit data for decorative masonry units and fabricated wire reinforcement, wall ties, anchors and other accessories.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

- D. Test Reports: Submit test results indicating compressive strength, water absorption, saturation and suction.
- E. Shop drawings: Show fabrication and installation details for following:
 - 1. Reinforcing Steel: Provide detailed drawings that give the quantity, size, dimensions, spacing, locations, bends, lap lengths, and other information required for reinforcement fabrication and installation. Comply with ACI 315, "Detail and Detailing of Concrete Reinforcement."
Show elevation of each reinforced walls with information noted above.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with TMS MSJC Code and TMS MSJC Specification.
- B. Fire Performance Characteristics: Where fire-resistance ratings are indicated, provide materials and construction which are identical to those of assemblies who fire endurance has been determined by testing in compliance with ASTM E119 by a recognized testing and inspecting organization or by another means, as acceptable to authorities having jurisdiction.
- C. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 MOCKUP

- A. Section 01 4000 - Quality Requirements: Mockup requirements.
- B. Construct cavity masonry wall mockup, 8 feet long by 6 feet high, including masonry, mortar and accessories, structural backup, flashings, wall insulation and weeps.
- C. Locate where directed at the project site.
- D. Incorporate accepted mockup as part of Work.

1.8 PRE-INSTALLATION MEETINGS

- A. Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Cold Weather Requirements: IMIAC – Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- C. Perform the following construction procedures while masonry work is progressing. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10 degrees F.
 - 1. 40 degrees F to 32 degrees F:
 - a. Mortar: Heat mixing water to produce mortar temperature between 40 degrees F and 120 degrees F.
 - b. Grout: Follow normal masonry procedures.
 - 2. 32 degrees F to 25 degrees F:
 - a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 degrees F and 120 degrees F; maintain temperature of mortar on boards above freezing.
 - b. Grout: Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of work day.
 - 3. 25 degrees F to 20 degrees F:
 - a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 degrees F and 120 degrees F; maintain temperature of mortar on boards above freezing.
 - b. Grout: Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of work day.
 - c. Heat both sides of walls under construction using salamanders or other heat sources.
 - d. Use windbreaks or enclosures when wind is in excess of 15 mph.
 - 4. 20 degrees F and below:
 - a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 degrees F and 120 degrees F.
 - b. Grout: Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of work day.
 - c. Masonry Units: Heat masonry units so that they are above 20 degrees F at time of laying.
 - d. Provide enclosure and auxiliary heat to maintain an air temperature

- of at least 40 degrees F for 24 hours after laying units.
 - e. Do not heat water for mortar and grout to above 160 degrees F.
- D. Protect completed masonry and masonry not being worked on in the following manner. Temperature ranges indicated apply to mean daily air temperatures except for grouted masonry. For grouted masonry temperature ranges apply to anticipated minimum night temperatures.
 - 1. 40 degrees F to 32 degrees F:
 - a. Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.
 - 2. 32 degrees F to 25 degrees F:
 - a. Completely cover masonry with weather-resistive membrane for at least 24 hours.
 - 3. 25 degrees F to 20 degrees F:
 - a. Completely cover masonry with weather-resistive insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.
 - 4. 20 degrees F and below:
 - a. Except as otherwise indicated, maintain masonry temperature above 32 degrees F for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps or other methods proven to be satisfactory. For grouted masonry maintain heated enclosure to 40 degrees F for 48 hours.

1.11 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 and hold cover securely in place.
 - 2. Where one wythe of multwythe masonry walls is completed in advance of other wythe, 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 a least 12 hours and concentrated loads for Least 3 days after building masonry walls or columns.

1.12 COORDINATION

- A. Administrative Requirements: Coordination and project conditions.

- B. Coordinate masonry work with installation of window and door anchors.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. Hollow Load Bearing Concrete Masonry Units (CMU): ASTM C90, Type I - Moisture Controlled; normal weight.
- B. Concrete Masonry Unit Size and Shape: Nominal modular size (width) as indicated on the Drawings. Furnish special units for 90 degree corners, bond beams, lintels, bullnosed corners. Provide bullnose units for outside corner, unless otherwise indicated.

2.2 LINTELS

- A. Build-In-Place Masonry Lintels. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.
- B. Steel Lintels: Sizes as indicated on the drawings, hot-dip galvanized.

2.3 ACCESSORIES

- A. Single Wythe Joint Reinforcement: Truss type; steel wire, hot dip galvanized to ASTM A641 Class 3 after fabrication; 3/16 inch side rods with 9 gage cross ties.
- B. Multiple Wythe Joint Reinforcement: Truss type; with moisture drip; steel wire, hot dip galvanized to ASTM A641 Class 3 after fabrication, 3/16 inch side rods, 9 gage cross ties.
- C. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade, deformed billet bars, uncoated finish.
- D. Strap Anchors: bent steel shape, as detailed on drawings, hot dip galvanized to ASTM A153 B2 finish.
- E. Wall Ties (CMU Back-up): Formed steel wire, 9 gage thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A153 B2 finish.
- F. Wall Ties (Frame Back-up): Formed steel wire, 12 gage, with tab plates galvanized to ASTM A153 finish. Plates secured to substrate with corrosion resistant screws as recommended by the Manufacturer.
- G. Anchor Bolts: Headed, J-shaped or L-shaped.
- H. Mortar and Grout: As specified in Section 04 0513.
- I. Flashings: 40 mil thick non asphaltic composite membrane "TeXtro Flash Hohman & Barnard or 3 oz/sq ft rolled sheet copper bonded to fiber reinforced

asphalt treated Kraft paper; “Cop-R-Tex” manufactured by Wasco or equal of AFCO, Hohmann & Barnard, Sandell or York.

- J. Termination Bars: Hohmann & Barnard T2 Aluminum Termination Bar, 14 ga. Or equal.
- K. Sealant for Termination Bars: Hohmann & Barnard HB Sealant or equal
- L. Drip Plate/Edge: Hohman & Barnard DP-LB 26 gauge type 304 stainless steel or equal.
- M. Preformed Control Joints: Rubber, Neoprene or Polyvinyl chloride material. Furnish with corner and tee accessories, heat or cement fused joints.
- N. Joint Filler: Closed cell polyethylene ; oversized 50 percent to joint width; self expanding; maximum lengths.
- O. Building Paper/Air Barrier/Weather Resistant Barrier: Tyvek Commercial Wrap or Stucco Wrap determined by location. Install at entire building envelope whether indicated on the drawings or not. Other manufacturers as approved by the Architect.
- P. Weeps: Cotton rope or tubes.
- Q. Cavity Vents: Molded polyvinyl chloride grilles; insect resistant. “Vinyl Block Vent” manufactured by Williams Products or Architect approved equal.
- R. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
- S. Cavity Drainage System: Mortar Net or others as approved by the Architect.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Administrative Requirements: coordination and project conditions.
- B. Verify field conditions are acceptable and are ready to receive work.
- C. Verify items provided by other sections of work are properly sized and located.
- D. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other sections.
- B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

UNIT MASONRY

3.3 INSTALLATION

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.
- C. Coursing of Concrete Masonry Units:
 - 1. Bond: Running. Unless Stacked is indicated.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave typical; Flush where a direct applied finish occurs other than paint.
- D. Coursing of Decorative Units:
 - 1. Bond: Stacked. Unless otherwise indicated.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave.
- E. Placing And Bonding:
 - 1. Lay solid masonry units in full bed of mortar, with full head joints.
 - 2. Lay hollow masonry units with face shell bedding on head and bed joints.
 - 3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
 - 4. Remove excess mortar as work progresses.
 - 5. Interlock intersections and external corners.
 - 6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
 - 7. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
 - 8. Cut mortar joints flush where wall tile is scheduled.
 - 9. Isolate masonry from vertical structural framing members with movement joint.
 - 10. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.
- F. Weeps and Vents: Furnish weeps and vents in outer wythe at 24 inches oc horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.
- G. Cavity Wall: Do not permit mortar to drop or accumulate into cavity air space or to plug weeps. Build inner wythe ahead of outer wythe to receive cavity insulation and air/vapor barrier adhesive.
- H. Joint Reinforcement And Anchorage - Single Wythe Masonry:
 - 1. Install horizontal joint reinforcement 16 inches oc., unless otherwise indicated.

2. Install horizontal joint reinforcement 8 inches oc., at parapet walls
3. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
4. Place joint reinforcement continuous in first and second joint below top of walls.
5. Lap joint reinforcement ends minimum 6 inches.
6. Reinforce joint corners and intersections with strap anchors 16 inches oc.

I. Joint Reinforcement And Anchorage - Masonry Veneer:

1. Install horizontal joint reinforcement 16 inches oc., unless otherwise indicated.
2. Install horizontal joint reinforcement 8 inches oc., at parapet walls.
3. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
4. Place joint reinforcement continuous in first and second joint below top of walls.
5. Lap joint reinforcement ends minimum 6 inches.
6. Embed wall ties in masonry backing to bond veneer at maximum 16 inches oc vertically and 16 inches oc horizontally. Place at maximum 3 inches oc each way around perimeter of openings, within 12 inches of openings.
7. Secure anchors to stud framed backing and embed into masonry veneer at maximum 16 inches oc vertically and 16 inches oc horizontally. Place at maximum 3 inches oc each way around perimeter of openings, within 12 inches of openings.
8. Reinforce joint corners and intersections with strap anchors 16 inches oc.

J. Joint Reinforcement And Anchorages - Cavity Wall Masonry:

1. Install horizontal joint reinforcement 16 inches oc., unless otherwise indicated.
2. Install horizontal joint reinforcement 8 inches oc., at parapet walls
3. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
4. Place joint reinforcement continuous in first and second joint below top of walls.
5. Lap joint reinforcement ends minimum 6 inches.
6. Reinforce joint corners and intersections with strap anchors 16 inches oc.

K. Reinforcement And Anchorages - Multiple Wythe Unit Masonry:

1. Install horizontal joint reinforcement 16 inches oc., unless otherwise indicated.
2. Install horizontal joint reinforcement 8 inches oc., at parapet walls.
3. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

4. Place joint reinforcement continuous in first and second joint below top of walls.
5. Lap joint reinforcement ends minimum 6 inches.
6. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
7. Reinforce joint corners and intersections with strap anchors 16 inches oc.

L. Masonry Flashings:

1. Extend flashings horizontally through outer wythe at foundation walls, above ledge or shelf angles and lintels, under parapet caps, at bottom of walls, and turn down on outside face to form drip.
2. Turn flashing up minimum 8 inches and bed into mortar joint of masonry or seal to concrete or seal to sheathing over backing.
3. Lap end joints minimum 6 inches and seal watertight.
4. Turn flashing, fold, and seal at corners, bends, and interruptions.

M. Lintels:

1. Provide masonry 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.
2. Provide minimum bearing for 8 inches at each jamb, unless otherwise indicated.

N. Grouted Components:

1. Reinforce bond beam with 2 No. 5 bars, 2 inch from bottom web.
2. Reinforce pilaster with bars, as detailed on the drawings.
3. Lap splices bar diameters required by code.
4. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch dimensional location.
5. Place and consolidate grout fill without displacing reinforcing.
6. At bearing locations, fill masonry cores with grout for required bearing, both sides of opening; refer to the lintel schedule on the Drawings.

O. Reinforced Masonry:

1. Lay masonry units with core cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
2. Place mortar in masonry unit bed joints back 1/4 inch from edge of unit grout spaces, bevel back and upward. Permit mortar to cure 7 days before packing grout.
3. Place reinforcement bars as indicated on Drawings.
4. Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters.
5. Splice reinforcement as indicated.
6. Support and secure reinforcement from displacement.
7. Place and consolidate grout fill without displacing reinforcing.
8. Place grout in accordance with TMS MSJC Specification.

P. Control And Expansion Joints:

1. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
2. If locations of control joints are not indicated on the Drawings provide as follows. Not less than a control joint every 25' of wall. Other locations are at changes in wall height or thickness, at construction joints in foundations, roof or floors, at chases and recesses for piping, columns and fixtures, at one side of wall openings 6' or less and both sides of wall openings over 6'. If the shape and design of the structure causes excessive number of control joints, review locations with Architect.
3. Do not continue horizontal joint reinforcement through control and expansion joints.
4. Install preformed control joint device in continuous lengths. Seal butt and corner joints.
5. Size control joint in accordance with Section 07900 for sealant performance.
6. Form expansion joint by omitting mortar and cutting unit to form open space.

Q. Built-In Work:

1. As work progresses, install built-in metal door and glazed frames, fabricated metal frames, window frames, anchor bolts, and other items to be built-in the work and furnished by other sections.
2. Install built-in items plumb and level.
3. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
4. Do not build in materials subject to deterioration.

R. Cutting And Fitting:

1. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
2. Obtain Architect/Engineer's approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.4 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Maximum Variation From Alignment of Columns and Pilasters: 1/4 inch.
- C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

- E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- G. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
- H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 01 4000 – Quality Requirements: Testing and Inspection Services.
- B. Concrete Masonry Units: Test each type in accordance with ASTM C140.

3.6 CLEANING

- A. Section 01 7000 - Execution Requirements: Final cleaning.
- B. Remove excess mortar and mortar smears as work progresses.
- C. Replace defective mortar. Match adjacent work.
- D. Clean soiled surfaces with cleaning solution.
- E. Use non-metallic tools in cleaning operations.

END OF SECTION 04 2100

SECTION 06 1053 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Provide wood framing, nailers, blocking in wall and roof openings throughout project is required; wood furring and grounds; concealed wood blocking for support of toilet and bath accessories and all items that need to be fastened, wall cabinets, wood trim, wood sheathing and panels; and other items as required to complete construction.
- B. Wood treatment.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A208.1 - Mat-Formed Wood Particleboard.
- B. American Wood-Preservers' Association:
 - 1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
 - 2. AWPA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.
- C. National Institute of Standards and Technology:
 - 1. NIST PS 20 - American Softwood Lumber Standard.
- D. The Redwood Inspection Service:
 - 1. RIS - Standard Specifications for Grades of California Redwood Lumber.
- E. Southern Pine Inspection Bureau:
 - 1. SPIB - Standard Grading Rules for Southern Pine Lumber.
- F. West Coast Lumber Inspection Bureau:
 - 1. WCLIB - Standard Grading Rules for West Coast Lumber.
- G. Western Wood Products Association:
 - 1. WWPA G-5 - Western Lumber Grading Rules.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.

- B. Product Data: Submit technical data on wood preservative and fire retardant treatment materials and application instructions.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. Lumber Grading Agency: Certified by NIST PS 20.
 - 2. Plywood Grading Agency: Certified by APA/EWA.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Lumber Grading Rules: AP&PA, RIS, SPIB, WCLIB, WWPA G-5.
- B. Miscellaneous Framing: Stress Group D, yellow pine species, 19 percent maximum moisture content, fire retardant treated interior and pressure preservative treated exterior.
- C. Exterior Plywood: APA/EWA Rated Sheathing Structural I, Grade C-D; Exposure Durability 1; unsanded.
- D. Interior Plywood: APA/EWA Rated Sheathing Structural I, Grade C-D; fire-retardant treated.

2.2 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Fasteners: Stainless steel for high humidity and treated wood locations, unfinished steel elsewhere.
 - 2. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

2.3 FACTORY WOOD TREATMENT

- A. Preservative Treatment by Pressure Process: AWPAC2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPAC31 with inorganic boron (SBX).
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Wood Preservative (Pressure Treatment): Equal to Wolmanized Outdoor Wood protected by a fortified type C formulation of micronized copper azole. .06 retention for above ground use and .15 for ground contact use.
- C. Fire Retardant Treatment: Pressure treatment, AWPAC20 for lumber and AWPAC27 for plywood, Interior Type, chemically treated and pressure impregnated;

capable of providing a maximum flame spread/smoke development rating of 25/450.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify substrate conditions are ready to receive blocking, curbing, and framing.

3.2 PREPARATION

- A. Coordinate placement of blocking, curbing, and framing as required to complete construction.

3.3 INSTALLATION

- A. Set members level and plumb, in correct position.
- B. Place horizontal members, crown side up.
- C. Space framing and furring 16 inches oc.
- D. Secure sheathing to framing members with ends over firm bearing and staggered.

END OF SECTION 06 1053

SECTION 06 1643 - GYPSUM SHEATHING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Fiberglass-mat faced, moisture and mold resistant gypsum sheathing.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C473 Standard Test Methods for Physical Testing of Gypsum Panel Products.
 - 2. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 3. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - 4. ASTM C1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - 5. ASTM C1280 Standard Specification for Application of Gypsum Sheathing.
 - 6. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 - 7. ASTM D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.
 - 8. ASTM E72 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
 - 9. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.
 - 10. ASTM C1396 Standard Specification for Gypsum Board
 - 11. ASTM E 136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
 - 12. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
- B. Gypsum Association (GA): GA-253 Application of Gypsum Sheathing.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's specifications and installation instructions for each product specified.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Fiberglass-Mat Faced Gypsum Sheathing:
 - 1. DensGlass Sheathing by Georgia Pacific.
 - 2. Securock by USG

2.2 MATERIALS

- A. Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177:
 - 1. Thickness: 1/2 inch.
 - 2. Width: 4 feet.
 - 3. Length: [8 feet] [9 feet] [10 feet].
 - 4. Weight: 1.9 lb/sq. ft.
 - 5. Edges: Square.
 - 6. Surfacing: Fiberglass mat on face, back, and long edges.
 - 7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 540 pounds per square foot, dry.
 - 8. Flexural Strength, Parallel (ASTM C473): 80 lbf, parallel.
 - 9. Humidified Deflection (ASTM C1177): Not more than 2/8 inch.
 - 10. Permeance (ASTM E96): Not less than 23 perms.
 - 11. R-Value (ASTM C518): 0.56.
 - 12. Mold Resistance (ASTM D3273): 10, in a test as manufactured.
 - 13. Microbial Resistance (ASTM D6329, UL Environmental GREENGUARD 3-week protocol): Will not support microbial growth.
 - 14. Acceptable Products:
 - a. 1/2 inch DensGlass Sheathing, Georgia-Pacific Gypsum LLC.

2.3 ACCESSORIES

- A. Screws: ASTM C1002, corrosion resistant treated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 - 1. Inspection: Verify that project conditions and substrates are acceptable to the installer, to begin installation of work of this section.

3.2 INSTALLATION

- A. General: In accordance with GA-253, ASTM C1280 and the manufacturer's recommendations.

3.3 PROTECTION

- A. Protect gypsum board installations from damage and deterioration until date of Substantial Completion.

END OF SECTION 06 1643

SECTION 07 2116 - BATT INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes batt insulation and vapor retarder.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. National Fire Protection Association:
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- C. Underwriters Laboratories Inc.:
 - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on product characteristics, performance criteria, limitations.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 BATT INSULATION

- A. Manufacturers:
 - 1. CertainTeed Insulation.
 - 2. Johns Manville.
 - 3. Knauf Fiber Glass.
 - 4. Owens Corning Fiberglas.

2.2 COMPONENTS

- A. Batt Insulation: ASTM C665; preformed glass fiber batt ; friction fit, conforming to the following:

1. Thermal Resistance/Thickness: As indicated on the Drawings.
 2. Facing: Un-faced.
 3. Flame/Smoke Properties: 25/50 in accordance with ASTM E 84.
- B. Sheet Vapor Retarder: MemBrain as manufactured by Certainteed or Architect approved equal.
- C. Tape: Polyethylene self-adhering type, 2 inch minimum wide.
- D. Insulation Fasteners: Steel impale spindle and clip on flat metal base, self adhering backing, length to suit insulation thickness, capable of securely and rigidly fastening insulation in place.
- E. Wire Mesh: Galvanized steel, hexagonal wire mesh as required.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Administrative Requirements: Coordination and project conditions.
- B. Verify substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.2 INSTALLATION

- A. Install insulation and vapor retarder in accordance with insulation manufacturer's instructions.
- B. Install in exterior spaces indicated on the drawings without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.
- E. Install sheet vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.
- F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- G. Metal Framing: Place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.
- H. Extend vapor retarder tight to full perimeter of adjacent window and door frames and other items interrupting plane of membrane. Tape seal in place.

END OF SECTION 07 2116

SECTION 07 2610 - BUILDING WRAP

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes building wrap.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data indicating material characteristics, performance criteria and limitations.
- C. Manufacturer's Installation Instructions: Submit preparation and installation requirements, techniques.

1.4 SEQUENCING

- A. Sequence Work to permit installation of materials in conjunction with other retardant materials and seals, and air barrier assemblies.
- B. Do not install building wrap until items penetrating wrap are in place.

PART 2 PRODUCTS

2.1 BUILDING WRAP

- A. Provide DuPont Tyvek Commercial Wrap or Architect Approved Equal.

2.2 ACCESSORIES

- A. Flashing Tape: DuPont Flashing Tape.
- B. Adhesive: DuPont Adhesive Primer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove loose or foreign matter capable of impairing adhesion.

- B. Clean and prime substrate surfaces to receive adhesive and sealants.

3.2 INSTALLATION

- A. Building Wrap for Exterior Walls: Secure sheet as recommended by the manufacturer. Provide continuous seal.

END OF SECTION 07 2610

SECTION 07 9200 - JOINT SEALERS

PART 1 GENERAL

1.1 SUMMARY

- A. Sections include sealants and joint backing, precompressed foam sealers, and accessories.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C834 - Standard Specification for Latex Sealants.
 - 2. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 - 3. ASTM C1193 - Standard Guide for Use of Joint Sealants.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- C. Samples: Submit two samples illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.
- E. Warranty: Include coverage for installed sealants and accessories failing to achieve watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum five years documented experience, and approved by manufacturer.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Products Requirements.
- B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.6 COORDINATION

- A. Administrative Requirements: Coordination and project conditions.

- B. Coordinate Work with sections referencing this section.

PART 2 PRODUCTS

2.1 JOINT SEALERS

A. Products Description:

1. High Performance General Purpose Exterior (Nontraffic) Sealant Silicone.
 - a. Color: Colors as selected by the Architect.
 - b. Acceptable Manufacturers/Products:
 - 1) Dow Corning; 790.
 - 2) GE Silicones; Silpruf
 - 3) GE Silicones: UltraPruf SCS2300.
 - 4) Pecora; 864.
 - 5) Pecora; 890.
 - 6) BASF; Omniseal.
 - 7) Tremco; Spectrem 1.
 - 8) SIKA
2. High Performance General Purpose Exterior (Nontraffic) Sealant Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; multi-component.
 - a. Color: Colors as selected by the Architect.
 - b. Acceptable Manufacturers/Products:
 - 1) Pecora; Dynatrol II.
 - 2) Sika; Sikaflex – 2c NS EZ
 - 3) Tremco; Dymeric 511.
 - 4) Bostik; Chem-Calk 2641.
 - 5) BASF; NP 2.
3. High Performance General Purpose Exterior (Nontraffic) Sealant Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single-component.
 - a. Color: Colors as selected by the Architect.
 - b. Acceptable Manufacturers/Products:
 - 1) Sika; Sikflex – 1a.
 - 2) BASF; NP 1.
 - 3) Bostik; Chem-Calk 900.
 - 4) Mameco; Vulkem 921.
 - 5) Pecora; Dynatrol I.
 - 6) Tremco; DyMonic.
4. General Purpose Traffic Bearing Sealant Polyurethane; ASTM C920, Grade P, Class 25, Use T; multi-component.
 - a. Color: Colors as selected by the Architect.
 - b. Acceptable Manufacturers/Products:
 - 1) Bostik; Chem-Calk 550.
 - 2) W.R. Meadows; Pourthane.
 - 3) Pecora; NR-200 Urexpan.

- 4) Pecora; NR-300 Urexpan, Type M.
 - 5) Sika; Sikaflex – 2c SL.
 - 6) BASF; SL 2.
 - 7) Tremco; THC-900.
 - 8) Tremco; THC-901.
5. Exterior Foam Expansion Joint Sealer: Precompressed foam sealer.
 - a. Color: Face color as selected by the Architect. Provide at least 11 colors to choose from.
 - b. Size: As required to provide watertight seal when installed.
 - c. Acceptable Manufacturers/Products:
 - 1) Emseal; Colorseal.
 - 2) Balco; BCSW.
 - 3) Construction Specialties
6. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
 - a. Color: Colors as selected by the Architect.
 - b. Acceptable Manufacturers/Products:
 - 1) Bostik; Chem-Calk 600.
 - 2) Pecora; AC-20.
 - 3) BASF; Sonolac.
 - 4) Tremco; Tremflex 834.
7. Plumbing Fixture Sealant: Silicone; ASTM C920, Uses M and A; single component, mildew resistant.
 - a. Color: White.
 - b. Acceptable Manufacturers/Products:
 - 1) Dow Corning; 786 Mildew Resistant.
 - 2) GE Silicones; Sanitary 1700.
 - 3) Pecora; 898 Silicone Sanitary Sealant.
 - 4) Tremco; Tremsil 600 white.
 - 5) SIKA
8. Low Modulus High Performance, 1 component, non-sag elastomeric sealant.
 - a. Color: Colors as selected by the Architect.
 - b. BASF; Sonolastic 150 with VLM Technology.
 - c. SIKAflex-15LM.

2.2 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM C 330; oversized 30 to 50 percent larger than joint width.

1. Type: C: Closed-cell material with surface skin.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces and joint openings are ready to receive work.
- C. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

- A. Remove loose materials and foreign matter impairing adhesion of sealant.
- B. Clean and prime joints.
- C. Perform preparation in accordance with ASTM C1193.
- D. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

- A. Perform installation in accordance with ASTM C1193.
- B. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
- C. Install bond breaker where joint backing is not used.
- D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Tool joints concave.
- G. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

3.4 CLEANING

- A. Division 01 - Execution Requirements: Final cleaning.
- B. Clean adjacent soiled surfaces.

JOINT SEALERS

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Division 01 - Execution Requirements: Protecting installed construction.
- B. Protect sealants until cured.

3.6 SCHEDULE

- A. Exterior Sealants:
 - 1. Door and window frame perimeters: silicone.
 - 2. All joints and openings with dissimilar materials: silicone.
 - 3. Expansion joints in a vertical plane: pre-compressed foam sealer.
 - 4. Masonry control joints: silicone.
 - 5. Unit masonry joints at lintels: silicone.
 - 6. Expansion Joints in a horizontal plane: polyurethane.
 - 7. Sheet metal joints, flashing, reglets: silicone.
 - 8. Metal curtain wall joints: silicone.
 - 9. Concrete panel joints: silicone or polyurethane.
 - 10. Plaza sealants: self-leveling polyurethane.
 - 11. EIFS joints: Low modulus high performance, 1 component, non sag elastomeric sealant.
- B. Interior Painted Caulks:
 - 1. Door and window frame perimeters: acrylic latex.
- C. Interior Non-Painted Caulks:
 - 1. Door and window frame perimeters: acrylic latex.
 - 2. All joints and openings with dissimilar materials: acrylic latex.
 - 3. Vertical expansion joints and masonry control joints: silicone.
 - 4. Unit masonry joints at lintels: silicone.
 - 5. Horizontal expansion joints: polyurethane.
 - 6. Sheet metal joints: polyurethane.
 - 7. Plumbing fixture perimeters: mildew resistant silicone.
 - 8. Structural pre-cast joints: non-sag polyurethane.
 - 9. Exposed concrete control joints: self-leveling polyurethane.
 - 10. Counter tops: silicone.

END OF SECTION 07 9200

SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes flush wood doors; fire rated and non-rated.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A135.4 - Basic Hardboard.
- B. ASTM International:
 - 1. ASTM E413 - Standard Classification for Rating Sound Insulation.
- C. Architectural Woodwork Institute:
 - 1. AWI - Quality Standards Illustrated.
- D. Forest Stewardship Council:
 - 1. FSC Guidelines - Forest Stewardship Council Guidelines.
- E. Hardwood Plywood and Veneer Association:
 - 1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.
- F. Intertek Testing Services (Warnock Hersey Listed):
 - 1. WH - Certification Listings.
- G. National Electrical Manufacturers Association:
 - 1. NEMA LD 3 - High Pressure Decorative Laminates.
- H. National Fire Protection Association:
 - 1. NFPA 80 - Standard for Fire Doors, Fire Windows.
 - 2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
- I. South Coast Air Quality Management District:
 - 1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.
- J. Underwriters Laboratories Inc.:
 - 1. UL - Building Materials Directory.
 - 2. UL 10B - Fire Tests of Door Assemblies.

3. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
4. UL 1784 - Air Leakage Tests of Door Assemblies.

K. Uniform Building Code:

1. UBC Standard 7-2 - Fire Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing.
- C. Product Data: Submit information on door core materials and construction, and on veneer species, type and characteristics.
- D. Samples:
 1. Submit two samples of door construction, 12 x 12 inch in size cut from top or bottom corner of door.
 2. Submit two samples of door veneer, 8 x 10 inch in size illustrating wood grain, stain color, and sheen.
- E. Manufacturer's Installation Instructions: Submit special installation instructions.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with AWI Quality Standard Section 1300, Premium grade.
- B. Finish doors in accordance with AWI Quality Standard Section 1500.
- C. Fire Rated Door and Panel Construction: Conform to one of the following:
 1. NFPA 252; with neutral pressure level at 40 inches (1015 mm) maximum above sill at 5 minutes into test.
 2. UL 10C.
 3. 20-Minute Fire Rated Corridor and Smoke Barrier Doors: Fire tested without hose stream test.
- D. Installed Fire Rated Door and Panel Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.
- E. Smoke and Draft Control Doors: Tested in accordance with UL 1784.
 1. Air Leakage: Maximum 3.0 cfm/sf (0.0154 cu m/s/sq m) of door opening with 0.10 inch water gage (24.9 Pa) pressure differential.
- F. Attach label from agency approved by authority having jurisdiction to identify each fire rated door.

1. Indicate temperature rise rating for stair doors.
2. Attach smoke label to smoke and draft control doors.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [documented] experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.

1.7 COORDINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work with door opening construction, door frame and door hardware installation.

1.8 WARRANTY

- A. Division 01 - Execution Requirements: Product warranties and product bonds.
- B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.
- C. Furnish manufacturer's "Life of Installation" warranty for interior doors.

PART 2 PRODUCTS

2.1 FLUSH WOOD DOORS

- A. Manufacturers:
 1. Masonite
 2. Eggers Industries.
 3. Oshkosh Door Company.
- B. Product Description: Solid core flush wood doors; wood veneer facing material; fire rated and non-rated types; flush design; factory pre-fit; shop finished wood doors.
 1. Flush Interior Doors: 1-3/4 inches thick; solid core, five or seven ply construction, fire rated as indicated on Drawings.
 2. Transom Panels: To match door, face veneer to end match, fire rated, as indicated on Drawings.

2.2 COMPONENTS

- A. Solid Core, Non-Rated: AWI Section 1300, Type PC - Particleboard.
- B. Solid Core, Fire Rated: AWI Section 1300, Type FD 1-1/2; Category A for positive pressure fire test.
- C. Interior Veneer Facing: AWI Premium quality wood, sliced to match existing with balanced match, book end matched grain, end matched transoms, for transparent finish. Pair match multiple door leaves in single opening.
 - 1. Wood: Plain sliced red oak.

2.3 ACCESSORIES

- A. Glazing Stops: Wood with metal clips for rated doors channel shape, mitered corners; prepared for countersink style tamper proof screws.

2.4 FABRICATION

- A. Fabricate doors in accordance with AWI Quality Standards requirements.
- B. Astragals for Fire Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors.
- C. Furnish lock blocks at lock edge and top of door for closer for hardware reinforcement.
- D. Vertical Exposed Edge of Stiles: Of same species as veneer facing.
- E. Fit door edge trim to edge of stiles after applying veneer facing.
- F. Bond edge banding to cores.
- G. At exterior doors, furnish aluminum flashing at top and bottom rail and sill of glazed openings for full thickness and width of door.
- H. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Furnish solid blocking for through bolted hardware.
- I. Factory fit doors for frame opening dimensions identified on shop drawings.
- J. Cut and configure exterior door edge to receive recessed weather stripping devices.
- K. Provide edge clearances in accordance with AWI 1300.

2.5 SHOP FINISHING

- A. Finish work in accordance with AWI - Section 1500 Factory Finishing; Premium Quality; Stained Transparent Type:

FLUSH WOOD DOORS

1. Conversion Varnish.
 2. Catalyzed Polyurethane.
 3. UV Cured Epoxy, Polyester, Urethane.
- B. Factory finish doors in stain color as selected by the Architect.
- C. Seal door top edge with sealer to match door facing.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

- A. Install doors in accordance with AWI Quality Standards requirements.
- B. Trim non-rated door width by cutting equally on both jamb edges.
- C. Trim door height by cutting bottom edges to maximum of 3/4 inch (19 mm).
1. Trim fire door height at bottom edge only, in accordance with fire rating requirements.
- D. Machine cut doors for hardware installation.
- E. Coordinate installation of doors with installation of frames and hardware.
- F. Install door louvers plumb and level.
- G. Coordinate installation of glass and glazing specified in Section 08800.

3.3 INSTALLATION TOLERANCES

- A. Division 01 - Quality Requirements: Tolerances.
- B. Conform to AWI requirements for fit and clearance tolerances.
- C. Maximum Diagonal Distortion (Warp): 1/8 inch (3 mm) measured with straight edge or taut string, corner to corner, over imaginary 36 x 84 inches (915 X 2 130 mm) surface area.
- D. Maximum Vertical Distortion (Bow): 1/8 inch (3 mm) measured with straight edge or taut string, top to bottom, over imaginary 36 x 84 inches (915 X 2 130 mm) surface area.

- E. Maximum Width Distortion (Cup): 1/8 inch (3 mm) measured with straight edge or taut string, edge to edge, over imaginary 36 x 84 inches (915 X 2 130 mm) surface area.

3.4 ADJUSTING

- A. Division 01 - Execution Requirements: Testing, adjusting, and balancing.
- B. Adjust door for smooth and balanced door movement.
- C. Adjust closer for full closure.

END OF SECTION 08 1416

SECTION 08 5200 - ALUMINUM WINDOWS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. All exterior windows furnished and installed as shown on drawings, specified in this section and designated in AAMA 101/I.S.2.
2. All labor, materials, tools, equipment and services needed to furnish and install Architectural Performance Class windows.
3. Insulated metal panels.
4. Components furnished with installed windows.
5. Installation accessories furnished and installed.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

A. Design Wind Loads

1. The design wind pressure for the project will be
 - a. Per local building codes
2. All structural components, including meeting rails, mullions and anchors shall be designed accordingly, complying with deflection and stress requirements of Paragraph 1.02 B.

B. Air, Water and Structural Performance Requirements

1. When tested in accordance with cited test procedures, windows shall meet or exceed the following performance criteria, as well as those indicated in AAMA 101/I.S.2 for Architectural (AW) Performance Class windows, Performance Grade 80 (AW80) unless otherwise noted herein.
2. Air Test Performance Requirements
 - a. Air infiltration maximum 0.1 cfm per square foot at 6.24 psf pressure differential when tested in accordance with ASTM E283.
3. Water Test Performance Requirements
 - a. No uncontrolled water leakage at 12.00 psf static pressure differential, with water application rate of 5 gallons/hr/sq ft when tested in accordance with ASTM E331.
4. Structural Test Performance Requirements
 - a. Uniform Load Deflection Test
 - 1) No deflection of any unsupported span L of test unit (framing rails, muntins, mullions, etc.) in excess of L/175 at both a positive and negative load of 80 psf (design test pressure) when tested in accordance with ASTM E330.
 - 2) Structural reinforcing that is not standard on units being furnished is not allowed.
 - b. Uniform Load Structural Test

- 1) Unit to be tested at 1.5 x design test pressure (120 psf), both positive and negative, acting normal to plane of wall in accordance with ASTM E330.
- 2) No glass breakage; permanent damage to fasteners, hardware parts, or anchors; damage to make windows inoperable; or permanent deformation of any main frame or ventilator member in excess of 0.2% of its clear span.

C. Life Cycle Testing:

1. When tested in accordance with AAMA 910-93, there is to be no damage to fasteners, hardware parts, support arms, activating mechanisms or any other damage that would cause the window to be inoperable at the conclusion of testing. Air infiltration and water resistance tests shall meet the primary performance requirements specified.

D. Condensation Resistance and Thermal Transmittance Performance Requirements

1. Perform thermal tests in accordance with the configuration specified in AAMA 1503.1.
 - a. Thermal Transmittance ("U" Factor) shall not exceed 0.46 BTU/hr/sf/deg F at 15 mph exterior wind.
 - b. Condensation Resistance Factor (CRF) requirements: CRF minimum 57 (Frame) and CRF minimum 57 (specimen).

1.3 SUBMITTALS

A. General Requirements

1. Provide all submittals in a timely manner to meet the required construction completion schedule.

B. Shop Drawings

1. Shop drawings must be prepared wholly by the window manufacturer, or a qualified engineering services firm under the direction of the manufacturer. Shop drawings for pre-engineered configurations may be prepared by installers authorized per 1.04 QUALITY ASSURANCE.
2. Provide design details along with bid proposals to define system aesthetic and functional characteristics.
3. Provide three photocopied sets of shop drawings, including half size details of all necessary conditions.

C. Samples

1. Components: Submit samples of anchors, fasteners, hardware, assembled corner sections and other materials and components as requested by Architect.
2. Finish: Submit color samples for Architect's approval as requested.

D. Test Reports and Calculations

1. Submit certified independent laboratory test reports verifying compliance with all test requirements of 1.02 SYSTEM PERFORMANCE REQUIREMENTS as requested by Architect.

1.4 QUALITY ASSURANCE

A. Qualifications

1. Upon request, the window manufacturer will provide written confirmation that the installer is authorized to install window products to be used on this project.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading

1. Materials will be packed, loaded, shipped, unloaded, stored and protected in accordance with AAMA CW-10.

1.6 WARRANTY

A. Aluminum Window Warranty

1. Products: Submit a written warranty, executed by the window manufacturer, for a period of 2 years (10 years for insulated glass seal failure) from the date of manufacture, against defective materials or workmanship, including substantial non-compliance with applicable specification requirements and industry standards, which results in premature failure of the windows, finish, factory-glazed glass, or parts, outside of normal wear.
 - a. In the event that windows or components are found defective, manufacturer will repair or provide replacements without charge at manufacturer's option.
 - b. Warranty for all components must be direct from the manufacturer (non-pass through) and non-prorated for the entire term. Warranty must be assignable to the non-residential owner, and transferable to subsequent owners through its length.
2. Installation: Submit a written warranty, executed by the window installer, for a period of 2 years from the date of substantial completion, against defective materials or workmanship, including substantial non-compliance with applicable specification requirements, which result in premature failure.
 - a. In the event that installation of windows or components is found to be defective, installer will repair or provide replacements without charge at the installer's option.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer

1. Drawings and specifications are based on:
 - a. Manko Window Systems, Inc. 3527i Series Fixed, Flush Projected Vent Windows.
 - b. Efco
 - c. Graham Architectural Products
 - d. Wausau
 - e. Peerless

B. Substitutions

1. Other manufacturers' products that meet or exceed specified design requirements may be considered. Submit the following information with request for substitutions at least ten (10) working days prior to bid date.
 - a. Test reports specified in 1.02 SYSTEM PERFORMANCE REQUIREMENTS
 - b. Full proposal details and samples specified in 1.03 SUBMITTALS
 - c. Copy of manufacturer's warranty specified in 1.06 WARRANTY
 - d. Other information as requested for evaluation

2.2 MATERIALS

A. Aluminum Members

1. Extruded aluminum prime billet 6063-T5 or 6063-T6 alloy for primary components; 6063-T5, 6063-T6, or 6061-T6 for structural components; all meeting the requirements of ASTM B221.
2. Aluminum sheet alloy 5005 H 32 (for anodic finish), meeting the requirements of ASTM B209 or alloy 3003 H 14 (for painted or unfinished sheet).

2.3 MANUFACTURED UNITS

A. Materials

1. Principal window frame members will be a minimum 0.094" in thickness at all structural areas, hardware mounting webs, and section flanges.
2. Extruded or formed trim components will be a minimum 0.062" in thickness.

B. Fabrication

1. Frame depth 3 1/2" minimum.
2. Sash depth 2 3/4" minimum.
3. Sash ventilator sections must be tubular.

2.4 COMPONENTS

- A. All steel components including attachment fasteners to be 300 series stainless steel except as noted.
- B. Extruded aluminum components 6063-T5 or 6063-T6.
- C. Locking handles, cases and strikes to be die cast or stainless steel.
- D. Thermoplastic or thermo-set plastic caps, housings and other components to be injection-molded nylon, extruded PVC, or another suitable compound.
- E. Hardware:
 - 1. Project-Out Vent
 - a. Hinges are to be two stainless steel concealed four-bar adjustable friction hinges per vent meeting AAMA 904.1.
 - b. Locks are to be standard die cast white bronze cam locks and strikes. Provide two locks for ventilators over 40".
 - 1) Standard project-out cam handle lock
 - c. Provide limited opening device/friction adjuster to limit initial sash operation to 6". Operation past this point to be by use of a tool or removable key.
 - 2. Fixed -- No Hardware Required
- F. Sealants
 - 1. All sealants shall comply with applicable provisions of AAMA 800 and/or Federal Specifications FS-TT-001 and 002 Series.
 - 2. Frame joinery sealants shall be suitable for application specified and as tested and approved by window manufacturer.
- G. Glass
 - 1. Provide sealed insulated glass shall meet ASTM E774 Class A.
 - 2. Exterior glass pane shall be 1/4" thick tempered with light bronze tint.
 - 3. Interior glass pane shall be 1/4" thick clear tempered.
- H. Glazing
 - 1. Glazing method shall be in general accordance with the FGMA Glazing Manual for specified glass type, or as approved by the glass fabricator.
- I. Glazing Materials
 - 1. Setting Blocks/Edge Blocking: Provide in sizes and locations recommended by FGMA Glazing Manual.
 - 2. Back-bedding tapes, expanded cellular glazing tapes, toe beads, heel beads and cap beads shall meet the requirements of applicable specifications cited in AAMA 800.

3. Glazing gaskets shall be non-shrinking, weather-resistant, and compatible with all materials in contact.
4. Structural silicone sealant where used shall meet the requirements of ASTM C 1184.
5. Spacer tape in continuous contact with structural silicone shall be tested for compatibility and approved by the sealant manufacturer for the intended application. Gaskets in continuous contact with structural silicone shall be extruded silicone or compatible material.

J. Steel Components

1. Provide steel reinforcements as necessary to meet the system performance requirements of 1.02.
2. Concealed steel anchors and reinforcing shall be factory painted after fabrication with rust-inhibitive primer complying with Federal Specification TT-P-645.

K. Thermal Break Construction:

1. Frame and sash members must include a thermal break applied in the manufacturer's facility, using concealed low conductance poured-in-place polyurethane in a pre-treated cavity.
2. After proper curing, the aluminum bridge section must be removed to provide a 1/4" separation between exterior and interior metal surfaces.

L. Weather Stripping:

1. Dual durometer PVC, neoprene, EPDM or other suitable material as tested and approved by the window manufacturer.
2. Bulb type at exterior vent members.
3. Securely stake and join at corners. Provide drainage to exterior as necessary.
4. Weather-stripping shall provide an effective pressure-equalization seal at the interior face of the sash ventilator.

M. Muntins:

1. Provide muntin grids as shown on architectural drawings.
2. Finish to match window frames.

N. Receptors/Sill Starter:

1. Provide extruded aluminum receptors to receive windows, as shown on architectural drawings.
2. Finish to match window frames.

O. Insect Screens:

1. Tubular extruded aluminum frames shall meet the requirements of ANSI/SMA 1004. Finish to match window frames.

2. Aluminum cloth shall comply with GSA-FS-RR-W-365 and USDC-CS-138 with 18 X 16 mesh. Cloth color shall be charcoal grey.

P. Insulated Metal Panels:

1. Provide Thermolite by Laminators Inc. or Architect approved equal. Stabilizers shall be corrugated polyallomer, EPS insulating core, .032 in. aluminum facers both sides, smooth, in kynar 500 or dark bronze anodized to match windows. Total thickness: 1 inch.

Q. Integral Venetian Blinds:

1. 5/8" wide aluminum slat blinds. Blind color shall be as selected by the Architect from the manufacturer's standard colors.
2. Blind to be integrally mounted between the dual glazing.
3. Tilt-control knob will be located on the interior face of access panel at the bottom of the right jamb. Provide wands for all knobs located over 48 inches above the floor. Raise and lower pull cords will be located between glass for access only when access panel is opened.
4. Tilt-control knob will incorporate a "slip clutch" feature.

2.5 FABRICATION

A. General:

1. Finish, fabricate and shop assemble frame and sash members into complete windows under the responsibility of one manufacturer.
2. No bolts, screws or fastenings to bridge thermal barrier or impair independent frame movement.
3. Fabricate to allow for thermal movement of materials when subjected to a temperature differential from -30 degrees F to +180 degrees F.

B. Frames:

1. Cope and mechanically fasten each corner or miter all corners and mechanically stake over a solid extruded aluminum corner key leaving only hairline joinery, then seal weather tight.

C. Main Sash Ventilator

1. Miter all corners and mechanically stake over a solid extruded aluminum corner key, leaving only hairline joinery, then seal weather tight.

2.6 FINISHES

A. Finish of Aluminum Components

1. Finish of all exposed areas of aluminum windows and components shall be done in accordance with the appropriate AAMA Voluntary Guide Specification shown.
 - a. Designation: AAM12C21A44

- b. Description: Electrolytically Deposited – Class I
- c. Standard: AAMA611
- d. Color: Dark Bronze

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions

1. Verify that building substrates permit installation of windows according to the manufacturer's instructions, approved shop drawings, calculations and contract documents.
2. Do not install windows until unsatisfactory conditions are corrected.

3.2 3.02 INSTALLATION

A. Erection of Aluminum Windows

1. Install windows with skilled tradesman in exact accordance with approved shop drawings, installation instructions, specifications, and AAMA 101/I.S.2.
2. Windows must be installed plumb, square and level for proper weathering and operation. Jambs must not be "sprung", bowed or warped during installation.
3. Aluminum that is not organically coated shall be insulated from direct contact with steel, masonry, concrete or other dissimilar metals by bituminous paint, zinc chromate primer, nonconductive shims or other suitable insulating material.

END OF SECTION 08 5200

SECTION 08 7100 - HARDWARE

PART 1 - GENERAL

1.1 Refer to "General and Special Conditions", and "Instructions to Bidders", Division 01 of Specifications. Requirements of these Sections and the project drawings shall govern work in this section.

1.2 Summary:

A. Section Includes:

1. Furnish all items of Finish Hardware specified, scheduled, shown or required herein except those items specifically excluded from this section of the specification.

1.3 Submittals:

A. Hardware Schedule

1. Submit number of Hardware Schedules as directed in Division 01.
2. Follow guidelines established in Door & Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule unless noted otherwise.
3. Schedule will include the following:
 - a. Door Index including opening numbers and the assigned Finish Hardware set.
 - b. Preface sheet listing category only and manufacturer's names of items being furnished as follows:

CATEGORY	SPECIFIED	SCHEDULED
Hinges	Manufacturer A	Manufacturer B
Lock sets	Manufacturer X	Manufacturer X
Kick Plates	Open	Manufacturer Z

- c. Hardware Locations: Refer to Article 3.1.B.2 Locations.
- d. Opening Description: Single or pair, number, room locations, hand, active leaf, degree of swing, size, door material, frame material, and UL listing.
- e. Hardware Description: Quantity, category, product number, fasteners, and finish.
- f. Headings that refer to the specified Hardware Set Numbers.
- g. Scheduling Sequence shown in Hardware Sets.
- h. Product data of each hardware item, and shop drawings where required, for special conditions and specialty hardware.
- i. Electrified Hardware system operation description.
- j. "Vertical" scheduling format only. "Horizontal" schedules will be returned "Not Approved."
- k. Typed Copy.
- l. Double-Spacing.
- m. 8-1/2 x 11 inch sheets
- n. U.S. Standard Finish symbols or BHMA Finish symbols.

B. Product Data:

1. Submit, in booklet form Manufacturers Catalog cut sheets of scheduled hardware.
2. Submit product data with hardware schedule.

C. Wiring Diagrams:

1. Submit elevation drawings showing relationship of all electrical and pneumatic hardware components to door and frame. Indicate number and gage of wires required.
 - a. Include wiring drawing showing point to point wire hook up for all components.
 - b. Include system operations descriptions for each type of opening; describe each possible condition.

D. Key Schedule:

1. Submit detailed schedule indicating clearly how the Owner's final keying instructions have been followed.
2. Submit as a separate schedule.

E. Samples:

1. Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample, if required, of each type of exposed hardware unit, finished as required and tagged with full description for coordination with schedule.
2. Samples will be returned to the supplier. Units, which are acceptable and remain undamaged through submittal, review and field comparison procedures, may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

F. Operations and Maintenance Manuals

1. Provide operations and maintenance manuals for each type of door hardware.

1.4 Quality Assurance

A. Requirements of Regulatory Agencies:

1. Furnish finish hardware to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed the requirements of the Specifications.
2. Furnish finish hardware to comply with the requirements of the regulations for public building accommodations for physically handicapped persons of the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.
3. Provide hardware for fire rated openings in compliance with NFPA 80 and state and local building code requirements. Provide only hardware that has been

tested and listed by UL for types and sizes of doors required and complies with requirements of door and door frame labels.

B. Supplier:

1. Mechanical Hardware

- a. Shall be an established firm dealing in contract builders' hardware. He must have adequate inventory, qualified personnel on staff and be located within 100 miles of the project. The distributor must be a factory-authorized dealer for all materials required. The supplier shall be or have in employment an Architectural Hardware Consultant (AHC).

2. Electrified Hardware:

- a. Shall be an experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.
- b. Shall prepare data for electrified door hardware, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this project.
- c. Shall have experience in providing consulting services for electrified door hardware installations.

C. Installer Qualifications:

1. 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. Pre-installation Meeting:

1. Before hardware installation, General Contractor/Construction Manager will request a hardware installation meeting be conducted on the installation of hardware; specifically that of locksets, closers, exit devices, overhead stops and coordinators. Manufacturer's representatives of the above products, in conjunction with the hardware supplier for the project, shall conduct the meeting. Meeting to be held at job site and attended by installers of hardware for aluminum, hollow metal and wood doors. Meeting to address proper coordination and installation of hardware, per finish hardware schedule for this specific project, by using installation manuals, hardware schedule, templates, physical product samples and installation videos.
2. When any electrical or pneumatic hardware is specified this meeting shall also include the following trades/installers: Electrical, Security, Alarm systems and Architect.
3. Convene one week or more prior to commencing work of this Section.

E. Manufacturer:

1. Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.

2. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Fire-Rated Door Assemblies:

1. Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
2. Positive Pressure Test: After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill.

1.5 Product Delivery, Storage, and Handling:

- A. Inventory door hardware on receipt.
- B. Label each item of hardware with the appropriate door number and Hardware Schedule heading number, and deliver to the installer so designated by the contractor.
- C. Provide secure lock-up for door hardware delivered to Project site.

1.6 Warranties:

- A. Refer to Division 01 for warranty requirements.
- B. During the warranty period, replace defective work, including labor, materials and other costs incidental to the work. Replace work found to be defective as defined in the General Conditions.

1.7 Maintenance and Service:

- A. Furnish a complete set of specialized tools for the Owner's continued adjustment, maintenance, and removal/replacement of door hardware.

PART 2 - PRODUCT

2.1 Manufacturers:

- A. Furnish each category with the products of only one manufacturer unless specified otherwise; this requirement is mandatory whether various manufacturers are listed or not.
- B. Provide the products of manufacturer designated or if more than one manufacturer is listed, the comparable product of one of the other manufacturers listed. Where only one manufacturer or product is listed, it is understood that this is the owner's Building Standard and "no substitution" is allowed.
- C. The first manufacture listed for each product is the manufacture used in the hardware sets.

2.2 Materials:

A. Screws and Fasteners:

1. Furnish fasteners of the proper type, size, quantity and finish. Use machine screws and expansion shields for attaching hardware to concrete or masonry, and wall grip inserts at hollow wall construction. Furnish machine screws for attachment to reinforced hollow metal doors and frames and reinforced aluminum doors and frames. Furnish full thread wood screws for attachment to solid wood doors and frames. "TEK" type screws are not acceptable.
2. Sex bolts will not be permitted on reinforced metal doors or wood doors where blocking is specified.

B. Hinges:

1. Quantity: Provide the following, unless otherwise indicated:
 - a. Two Hinges: For doors with heights up to 60 inches (1524 mm).
 - b. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).
 - c. Four Hinges: For doors with heights 91 to 120 inches (2311 to 3048 mm).
 - d. For doors with heights more than 120 inches (3048 mm), provide 4 hinges, plus 1 hinge for every 30 inches (750 mm) of door height greater than 120 inches (3048 mm).
2. Hinge Sizes: Provide the following, unless otherwise indicated:
 - a. 4-1/2 inches high: For all doors with widths of 36 inches or less.
 - b. 5 inches high: For all doors with widths greater than 36 inches.
3. Hinge Base Metal Thickness: Provide the following, unless otherwise indicated:
 - a. Medium Weight Doors with Medium Frequency: 0.134 inches thick.
 - b. Heavy Weight Doors with High Frequency: 0.180 inches thick.
4. Hinge Base Metal: Unless otherwise indicated, provide the following:
 - a. Exterior Hinges: Stainless steel, with stainless-steel pin.
 - b. Interior Hinges: Steel, with steel pin.
 - c. Hinges for Fire-Rated Assemblies: Steel, with steel pin.
5. Hinge Options: Where indicated in door hardware sets or on Drawings:
 - a. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for out-swinging exterior doors and out-swinging corridor doors with locks.
 - b. Corners: Square.
 - c. Width of Hinges: Shall be sufficient to clear all trim.
6. Fasteners: Provide Phillips flat-head screws comply with the following:
 - a. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
 - b. Wood Screws: For wood doors and frames.
 - c. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
 - d. Finish screw heads to match surface of hinges.
7. Manufacturers:
 - a. Ives; an Allegion Company (IVE).
 - b. Bommer Industries, Inc. (BOM).
 - c. Hager Companies (HAG).
 - d. Stanley; a Stanley Black and Decker Company (STA).
 - e. McKinney; an Assa Abloy Company (MCK).

C. Continuous Gear Hinge:

1. General: 6063-T6 aluminum alloy, anodized finish (cap on entire hinge painted if specified). Manufacture to template, uncut hinges non-handed, pinless assembly, three interlocking extrusions, full height of door and frame, lubricated polyacetal thrust bearing, fasteners 410 stainless steel plated and hardened. All hinge profiles to be manufactured to template bearing locations, with standard duty bearing configurations at 5-1/8" spacing with a minimum of 16 bearings: and heavy duty at 2-9/16" spacing with a minimum of 32 bearings. Anodizing of material shall be done after fabrication of components so that all bearing slots are anodized.
2. Length: 1" less than door opening height. Fastener 12-24 x 1/2" #3 Phillips keen form stainless steel self-tapping at aluminum and hollow metal doors, 12- 1/2" #3 Philips, flathead full thread at wood doors.
3. Furnish fire rated hinges "FR" at labeled openings.
4. Manufacturers:
 - a. For Wood and Hollow Metal frames;
 - 1) Manufacturers:
 - a) Ives; an Allegion Company, 224HD series (IVE).
 - b) Select Products Ltd., SL24HD series (SEL).
 - c) Pemko, FMHD series (PEM).
 - b. For Aluminum and FRP frames;
 - 1) Manufacturers:
 - a) Ives; an Allegion Company, 112HD series (IVE).
 - b) Select Products Ltd., SL11HD series (SEL).
 - c) Pemko, FMSLFHD series (PEM).

D. Door Bolts:

1. Flush Bolts
 - a. Automatic - metal doors:
 - 1) Ives; an Allegion Company, FB30 series (IVE).
 - 2) Equal product of any B.H.M.A. member.
 - b. Constant Latching: metal doors:
 - 1) Ives; an Allegion Company, FB50 series (IVE).
 - 2) Equal product of any B.H.M.A. member.
2. Dust Proof Strikes - furnish with all flush bolts, except at openings having thresholds:
 - a. Manufacturers:
 - 1) Ives; an Allegion Company, DP2 (IVE).
 - 2) Equal product of any B.H.M.A. member.

E. Coordinators:

1. Soffit Mounted:
 - a. Door coordinator shall prevent the active door from closing before inactive door. Stop mounted channel 1-5/8" x 5/8" steel tubing x length to suit door opening. Coordinator shall be UL listed. Furnish filler bars to fill gap between end of coordinator and inactive door frame. Furnish mounting brackets for all stop mounted hardware such as exit device strikes, door closer PA shoes, etc. Coordinators shall be prepared (cutout) at the factory for surface applied or concealed vertical rod panic devices if required.
 - b. Furnish with carry bar CB1 when required for proper operation.

- c. Manufacturers:
 - 1) Ives; an Allegion Company, COR x length to suit (IVE).
 - 2) Equal products of any BHMA manufacturer.

F. Locks and Latches:

1. Mortise Locks:

- a. All Mortise Locks shall be designed to meet BHMA A156.13, Grade 1 test standards and certified by an independent testing laboratory.
- b. Locksets shall be manufactured from heavy gauge steel, minimum lockcase thickness 1/8", containing components of steel with a zinc dichromate plating for corrosion resistance.
- c. Locks are to have a standard 2 3/4" backset with a full 3/4" throw two-piece stainless steel mechanical anti-friction latchbolt. Deadbolt shall be a full 1" throw, constructed of stainless steel.
- d. Lockcase shall be easily handed without chassis disassembly by removing handing screw on lockcase and installing in opposite location on reverse side. Changing of door hand bevel from standard to reverse hand shall be done by removing the lockcase scalp plate, and pulling and rotating the latchbolt 180 degrees.
- e. Lock trim shall be through-bolted to the door to assure correct alignment and proper operation. Lever trim shall have external spring cage mechanism to assist in support of the lever weight.
- f. Provide strikes with extended lips where required to protect trim from being marred by latch bolt. Provide strike lips that do not project more than 1/8" beyond door frame trim at single doors and have 7/8" lip to center at pairs of 1-3/4" doors.
- g. Manufacturers:
 - 1) Schlage; an Allegion Company, L9000 series (SCH).
 - 2) Best; a Stanley Black and Decker Company, 45H series (BES).
 - 3) Sargent; an ASSA Abloy Company, 8200 series (SAR).
- h. Lockset Trim:
 - 1) Schlage, 06A
 - 2) Best, 15H
 - 3) Sargent, LNL

2. Auxiliary Locks

- a. Deadlatch:
 - 1) Provide armor faceplate to suit door edge.
 - 2) Backset shall be 1 1/2" unless door stile width requires narrower backset.
 - 3) Provide a box lipped strike for deadlatches and a box non-lipped strike for deadlocks.
 - 4) Manufactures:
 - a) Adams Rite; an ASSA Abloy Company, 4900 series, (ADA).
 - b) Approved equals.

G. Exit Devices:

1. Touchpad Style:

- a. All exit devices shall meet ANSI A156.3, 1994, Grade 1 test standards.
- b. Devices shall be push through type with stainless steel touch pad design.

- c. Center Case: Shall be interchangeable with all functions.
- d. Mechanism End Cap: Shall be a stamped or forged metal. Plastic end caps will not be acceptable.
- e. Trim: Shall be heavy-duty type.
- f. Manufacturers:
 - 1) Von Duprin; an Allegion Company, 99/33A series (VON).
 - 2) Sargent; an ASSA Abloy Company, 80 series (SAR).
 - 3) Precision; a Stanley Black and Decker Company, Apex series (PRE).
- g. Trim:
 - 1) As specified in sets.
 - 2) Levers to match lockset design where specified.
- 2. Removable Mullion:
 - a. Interior/Exterior, mullion is removable only through the use of building keys.
 - 1) Von Duprin; an Allegion Company, KR4954 (VON).
 - 2) Equals by Sargent and Precision.
 - b. Interior Doors - UL listed, Mullion is removable only through the use of building keys.
 - 1) Von Duprin; an Allegion Company, KR9954 (VON).
 - 2) Equals by Sargent and Precision.

H. Surface Door Closers:

- 1. All Surface Door Closers shall be designed to meet BHMA A156.4, Grade 1 test standards and certified by an independent testing laboratory.
- 2. Door closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder.
- 3. Hydraulic fluid shall be of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to –30 degrees F.
- 4. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and backcheck.
- 5. All closers shall have solid forged steel main arms (and forged forearms for parallel arm closers).
- 6. All surface mounted mechanical closers shall be certified to exceed ten million (10,000,000) full load cycles by a recognized independent testing laboratory.
- 7. Refer to door and frame details and furnish accessories such as drop plates, panel adapters, spacers and supports as required to correctly install door closers. State degree of door swing in the hardware schedule.
- 8. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
- 9. Manufacturers:
 - a. LCN; an Allegion Company, 4000 series (LCN).
 - b. Sargent; an ASSA Abloy Company, 281 series (SAR).
 - c. Corbin Russwin; an ASSA Abloy Company, DC8000 series (COR).

I. Door Operators

- 1. Low Energy ADA Special Closers
 - a. Where “Low Energy Power Operated Door” as defined by ANSI Standard A156.19 is indicated for doors required to be accessible to the disabled,

provide electrically powered operators complying with the ADA requirements for opening force and time to close standards.

- b. Full closing force shall be provided when the power or assist cycle ends.
- c. Modular design, adjustments easily accessible from the front, UL listed for use on labeled doors.
- d. Shall have "Second Chance" function to accommodate momentary resistance, "Breakaway" function in the electronically controlled clutch, "Soft Start" motor control function and "Maintain Hold-Open Switch" to hold the door open at 90 degree.
- e. Shall have built in 12V and 24V power supply for actuators, card readers, electric strikes and magnetic door locks, inputs for both swing and stop side sensors and available to accept either 120VAC or 220VAC input power. All wiring connections between operator modules made by easy-to-handle electrical connectors. Shall comply with both UL and NEC requirements for Class 1 and Class 2 wiring by providing separate conduits for each.
- f. Shall have seven independent electronic adjustments to tailor the operator for specific site conditions. Opening speed, holding force at 90 deg., sequential trigger and time delay, hold-open time at 90 deg., opening force, clutch "breakaway" force setting, electric strike trigger and time delay.
 - 1) Shall have separate and independent adjustments for back check, main speed and latch speed.
- g. Furnish actuators and other controls as shown in Hardware Sets.
- h. Manufacturers:
 - 1) LCN; an Allegion Company, 4600 series (LCN).
 - 2) Besam, an ASSA Abloy Company, Power Swing series (BSM).
 - 3) Norton; an ASSA Abloy Company, 6900 series (NOR).

J. Door Trim:

- 1. Push Plates: 6 x 16 x .050 inches. If stile widths will not accept 6", provide stile width less 2".
- 2. Push Bars: dummy exit device.
- 3. Push-Pull Units: One inch round rod. Push: Straight push bar, Pull: 90 degree offset, 10" centers. Attach top post of pull back to back with latch stile end of push bar, bottom post of pull and hinge stile end of push bar with end caps.
- 4. Pull, Offset: One inch round rod, 90 degree offset, 10" centers.
- 5. Pull Plates: 4 x 16 x .050 inches. 10" center.
- 6. Manufacturers:
 - a. Ives; an Allegion Company, series as listed in sets (IVE).
 - b. Von Duprin; an Allegion Company, series as listed in sets (VON).
 - c. Equal products from any member of B.H.M.A.

K. Protection Plates:

- 1. Kick Plates:
 - a. Furnish beveled on 4 edges, countersink fasteners, .050" thick x 10" high x 1-1/2" less door width for the push side on single doors and 1" less door width for the pull side on single doors and push or pull side on pairs.
- 2. Mop Plates:

- a. Furnish beveled on 4 edges, countersink fasteners, .050" thick x 4" high x 1-1/2" less door width for the push side on single doors and 1" less door width for the pull side on single doors and push or pull side on pairs.
- 3. Manufacturers:
 - a. Ives; an Allegion Company, 8400 series (IVE).
 - b. Equal products of any B.H.M.A. manufacturer.

L. Door Stops:

- 1. Wall Bumpers:
 - a. Wrought, forged, or cast, approximately 2-1/2 inch diameter, convex or concave rubber center, concealed fasteners.
 - 1) Ives; an Allegion Company, WS402 (IVE).
 - 2) Equal products of any B.H.M.A. manufacturer.
- 2. Wall Stops:
 - a. Length to exceed projection of all other hardware. Provide with threaded studs and expansion shields for masonry wall construction. Install with slope at top.
 - 1) Ives; an Allegion Company, WS33 (IVE).
 - 2) Equal products of any B.H.M.A. manufacturer.
- 3. Floor Stops:
 - a. Half dome. Furnish height to suit undercut.
 - 1) Ives; an Allegion Company, FS436 series (IVE).
 - 2) Equal products of any B.H.M.A. manufacturer.
- 4. Overhead Stops and Holders:
 - a. Size per manufacturer's selector chart. Plastic end caps, hold open mechanisms and shock blocks are not allowed. End caps must be finished same as balance of unit.
 - b. Manufacture products using base material of Brass/Bronze for US3, US4, & US10B finished products and 300 Stainless Steel for US32 & US32D finished products.
 - c. Manufacturers:
 - 1) Glynn-Johnson; an Allegion Company, series as listed in sets (GLY).
 - 2) Equal products of any BHMA manufacturer.

M. Thresholds and Gasketing:

- 1. Thresholds:
 - a. 1/2" high - 5" wide. Cope at jambs.
 - b. Furnish full wall opening width when frames are recessed.
 - c. Cope in front of mullions if thresholds project beyond door faces.
 - d. Furnish with non-ferrous Stainless Steel Screws and Lead Anchors.
 - 1) National Guard Products Inc. as listed in sets (NGP).
 - 2) Equal of Zero or Reese
- 2. Door Sweeps:
 - a. Surface Sweeps:
 - 1) National Guard Products Inc., (NGP).
 - 2) Equal by Zero or Reese
- 3. Perimeter Gasketing:
 - a. Apply to head and jamb stops.
 - b. Solid Bar stock all sides

- 1) National Guard Products Inc., (NGP).
 - 2) Equal by Zero or Reese
4. Meeting Stile Gasketing:
 - a. 2 Pc. Nylon brush type to seal gap between pairs of doors.
 - 1) National Guard Products Inc., (NGP).
 - 2) Equal by Zero or Reese
5. Smoke and Draft Control Seals:
 - a. Gaskets must comply with UBC7.2 (1997) Part 2, UL1784 (1995), and NFPA 105 (1999) for use on all 'S' labeled wood and hollow-metal Positive Pressure door assemblies.
 - b. Perimeter Seals:
 - 1) National Guard Products Inc., 2525 (NGP).
 - 2) Zero
 - 3) Reese
 - c. Meeting Stile Astragal Seals:
 - 1) National Guard Products Inc., 600 (NGP).
 - 2) Zero
 - 3) Reese
 - d. Smoke Seals for doors with overlapping astragals:
 - 1) National Guard Products Inc., 2525 (NGP).
 - 2) Zero
 - 3) Reese
6. Fire and Smoke Seals:
 - a. Gaskets must comply with UBC7.2 (1997) Part 1 & 2, UL1784 (1995) NFPA 105 (1999) for use on (Category 'B') 20, 45, & 60 minute wood door assemblies:
 - b. Perimeter Seals:
 - 1) National Guard Products Inc., 9800 x 2525 (NGP).
 - 2) Zero
 - 3) Reese
 - c. Meeting Stile Astragal Seals:
 - 1) National Guard Products Inc., 9500 x 600 (NGP).
 - 2) Zero
 - 3) Reese
 - d. Fire and Smoke Seals for doors with overlapping astragals:
 - 1) National Guard Products Inc., 9800 x 2525 (NGP).
 - 2) Zero
 - 3) Reese
7. Fire and Smoke Seals:
 - a. Gaskets must comply with UBC7.2 (1997) Part 1 & 2, UL1784 (1995) NFPA 105 (1999) for use on (Category 'B') 90 – minute wood door assemblies:
 - b. Perimeter Seals:
 - 1) National Guard Products Inc., 9890 x 2525 (NGP).
 - 2) Zero
 - 3) Reese
 - c. Meeting Stile Astragal Seals:
 - 1) National Guard Products Inc., 9500 x 600 (NGP).
 - 2) Zero
 - 3) Reese
 - d. Fire and Smoke Seals for doors with overlapping astragals:

- 1) National Guard Products Inc., 9890 x 2525 (NGP).
- 2) Zero
- 3) Reese

N. Electrified Hardware

1. Power Transfers:
 - a. Transfer power from door frame to edge of door, UL listed R4504.
 - b. Power transfer to be concealed when door is closed.
 - c. Manufacturers:
 - 1) Von Duprin; an Allegion Company, EPT series (VON).
 - 2) Securitron; an Assa Abloy Company, CEPT series (SEC).
2. Power Supplies:
 - a. Universal 120-240 VAC input, low voltage DC regulated and filtered, fused primary input, NEMA 1 enclosure, high voltage protective cover, 12/24 VDC output field selectable with jumper, single polarized connector for distribution board.
 - b. Provide amperes greater than that of loads.
 - c. Manufacturers:
 - 1) Von Duprin; an Allegion Company, PS series (VON).
 - 2) Schlage; an Allegion Company, PS series (SCE).
 - 3) Securitron; an Assa Abloy Company, BPS series (SEC).
3. Electric Strike:
 - a. Electric strikes shall provide remote release of latchbolts. They shall be designed for use with the type locks shown at each opening where required. Strikes will be UL Listed for Burglary-Resistant Electric Door Strike, and where required, shall be UL listed as electric strikes for Fire Doors or Frames. Faceplates shall be stainless steel with finish as specified for each opening. The locking components shall be stainless steel to resist damage and abuse.
 - b. Solenoids shall be of the continuous duty type for the voltage specified. Plug connectors will be furnished. Strikes shall have an adjustable backbox to compensate for misalignment of door and frame.
 - c. Manufacturers:
 - 1) Von Duprin; an Allegion Company, 6000 series (VON).
 - 2) Folger Adams; a Southern Folger Company, 300 series (FOL).

O. Miscellaneous Hardware:

1. Silencers:
 - a. Provide silencers for all interior doors without gasketing.
 - 1) Ives; an Allegion Company, SR series (IVE).
 - 2) Equal product of any BHMA manufacturer

P. Furnish items not categorized in the above descriptions but specified by manufacturer's names in Hardware Sets.

2.3 Finishes:

- A. All new Aluminum Doors: Oil Rubbed Bronze, US10B / BHMA 613 Dull Chrome, All new Hollow Metal or Wood Doors: Satin Chromium US26D / BHMA 626.

2.4 Cylinders and Keying:

- A. All cylinders for this project will be supplied by one supplier regardless of door type and location.
- B. The Finish Hardware supplier will meet with Architect and/or Owner to finalize keying requirements and obtain keying instructions in writing.
- C. Provide a cylinder for all hardware components capable of being locked.
- D. Provide cylinders master and grand master keyed to existing Sargent (RDH keyway) system according to Owner's instructions.
- E. Provide cylinders with construction cores or keying for use during the construction period. When so directed, and in the presence of the Owner's security department or representative, convert construction cores or keying to the final system.
- F. When performing changeover from construction key system to final key system deliver to the Architect or Owner's Representative the following cut keys:
 - 1. 25 each Temporary construction Operating keys.
 - 2. 2 each Temporary construction Control Keys.
 - 3. 2 each Control Keys.
 - 4. 2 each Great Grand/Grand Master Keys.
 - 5. 4 each Master/Sub Master keys per group.
 - 6. 2 each Keys per cylinder.
- G. Manufacturers:
 - 1. Sargent; an ASSA Abloy Company, (SAR).

2.5 Key Control:

- A. Key Cabinet
 - 1. Provide a 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 percent of the number of locks required for the project.
 - 2. Provide complete cross-index system set up by hardware supplier or Lockset Manufacturers' representative or Lockset Manufacturers authorized Service Center. Place keys on markers and hooks in the cabinet as determined by the final key schedule. Provide hinged panel type cabinet for wall mounting. Provide one each wall mounted key cabinet. Provide loan record system.
 - 3. Manufacturers:
 - a. Telkee

2.6 Templates and Hardware Location:

- A. Furnish hardware made to template. Supply required templates and hardware locations to the door and frame manufacturers.
- B. Furnish metal template to frame/door supplier for continuous hinge.

PART 3 - EXECUTION

3.1 Installation

A. General:

1. Install hardware according to manufacturer's installations and template dimensions. Attach all items of finish hardware to doors, frames, walls, etc. with fasteners furnished and required by the manufacture of the item.
2. Provide blocking/reinforcement for all wall mounted Hardware.
3. Reinforced hollow metal doors and frames and reinforced aluminum door and frames will be drilled and tapped for machine screws.
4. Solid wood doors and frames: full thread wood screws. Drill pilot holes before inserting screws.
5. Continuous gear hinges attached to hollow metal doors and frames and aluminum doors and frames: 12-24 x 1/2" #3 Phillips Keenform self-tapping. Use #13 or 3/16 drill for pilot.
6. Continuous Gear Hinges require continuous mortar guards of foam or cardboard 1/2" thick x frame height, applied with construction adhesive.
7. Install weather-strip gasket prior to parallel arm closer bracket, rim exit device or any stop mounted hardware. Gasket to provide a continuous seal around perimeter of door opening. Allow for gasket when installing finish hardware. Door closers will require special templating. Exit devices will require adjustment in backset.
8. Overhead stops shall be templated to allow doors widest opening possible with surrounding wall configuration; default shall be set at 110 degree opening.
 - a. Contractor shall verify in field if 110 degree opening stop setting is achievable prior to fabrication of door and frames.
 - b. Indicate on submittals where overhead stops are set to less than 110 degree opening and request Architect's approval for each instance.
9. Door closers shall be templated to allow doors widest opening possible with surrounding wall configuration.

B. Locations:

1. Dimensions are from finish floor to center line of items.
2. Include this list in Hardware Schedule.

CATEGORY

Hinges
Flush Bolt Levers

DIMENSION

Door Manufacturer's Standard
72" and 12"

Levers	Door Manufacturer's Standard
Exit Device Touchbar	Per Template
Deadlatch Cylinder	43" unless conflicting with push-pull.
Offset Pulls	Suitable for Exit Devices
Push Plates	50" Centerline of Plate
Pull Plates	50" Centerline of Pull
Wall Stops/Holders	At Head

C. Installation of Access Control Components:

1. Electrical Contractor shall be responsible for supplying and installing high voltage wiring to the access control panels, automatic door operators and to all doors requiring 110V to the low voltage power supplies. Includes mounting power supply boxes to the walls, supplied through door hardware sets and terminating high voltage to the power supplies. Terminations of the low voltage electrified door hardware shall be the responsibility of access control contractor including push buttons for automatic operators. Conduit for access control, automatic operators and all electrified door hardware by electrical contractor.
2. Access Control Supplier/Contractor shall be responsible for supplying and installing all low voltage wiring necessary to complete the installation of wall mounted card readers, reader interfaces, etc. and electrified door hardware/accessories. Low voltage wire terminations of the access control panel, electrified door hardware, and power supplies shall be the responsibility of access control supplier/contractor.

D. Final Adjustment:

1. The general contractor shall provide the services of a representative to inspect material furnished and its installation and adjustment, and to instruct the Owner's personnel in adjustment, care and maintenance of hardware.
2. Locksets, closers and exit devices shall be inspected by the factory representative to insure correct installation and proper adjustment in operation. The manufacturer's representative shall prepare a written report stating compliance, and also recording locations and kinds of non-compliance. The original report shall be forwarded to the Architect with copies to the Contractor, hardware supplier, hardware installer and building owner.

E. Technical and Warranty Information:

1. At the completion of the project, the technical and warranty information coalesced and kept on file by the General Contractor/Construction Manager shall be given to the Owner or Owner's Agent. In addition to both the technical and warranty information, all factory order acknowledgement numbers supplied to the General Contractor/Construction Manager during the construction period shall be given to the Owner or Owner's Agent. The warranty information and factory order acknowledgement numbers shall serve to both expedite and properly execute any warranty work that may be required on the various hardware items supplied on the project.

3.2 Hardware Sets:

Door normally closed and locked. Presenting a valid credential to the reader will momentarily retract the panic device latch allowing access. Door to remain locked with loss of power or activation of the fire alarm. Free egress at all times.

Business Hours: Door(s) normally closed and unlocked via the access control system.

After Hours: Door(s) normally closed and locked. Presenting a valid credential to the reader will momentarily retract the panic device latch allowing access. Door to remain locked with loss of power or activation of the fire alarm. The request to exit feature of the lock to shunt the alarm output of the door contact. Door contact monitors whether the door is open or closed. Free egress at all times.

END OF SECTION 08 7100

SECTION 08 8000 - GLAZING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes glass and glazing.
- B. Section includes glass film.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.
- B. American Society of Civil Engineers:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International:
 - 1. ASTM C1036 - Standard Specification for Flat Glass.
 - 2. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures : Submittal procedures.
- B. Shop Drawings:
 - 1. Indicate sizes, layout, thicknesses, and loading conditions for glass.

1.4 SUSTAINABLE DESIGN SUBMITTALS

- A. Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
 - 1. Materials Resources Certificates:
 - a. Certify recycled material content for recycled content products.
 - b. Certify source for local and regional materials and distance from Project site.
 - 2. Indoor Air Quality Certificates:
 - a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.

- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

- 1. Provide cost data for the following products:
 - a. Products with recycled material content.
 - b. Local and regional products.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not install glazing when ambient temperature is less than 50 degrees F (10 degrees C).
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

PART 2 PRODUCTS

2.1 FLOAT GLASS MATERIALS

- A. Tempered Glass: ASTM C1048, Type 1 transparent flat, Quality Q3, Kind FT fully tempered, Condition A uncoated, float glass with horizontal tempering.
 - 1. Furnish tempered glass where heat strengthened glass cannot meet specified performance requirements.

2.2 FLOAT GLASS PRODUCTS

- A. Float Glass Manufacturers:
 - 1. ACH Glass Operations.
 - 2. AFG Industries, Inc.
 - 3. Guardian Industries Corp.
 - 4. PPG Industries
 - 5. Pilkington North America, Inc.
 - 6. Or Approved Equal.
- B. Clear Glass: Tempered float glass as specified; Class 1 clear.
 - 1. Minimum Thickness: 1/4.

2.3 SECURITY GLASS:

- A. Single Pane: 5/16 inch thick overall laminated glass. 1/8 inch thick annealed laminated x .060 PVB interlayer x 1/8 thick annealed glass.
- B. Insulating Security Glass: Units include 5/16 inch thick overall laminated glass. 1/8 inch thick annealed laminated x .060 PVB interlayer x 1/8 thick annealed glass; ½ air space; 1/4 inch tempered pane.

2.4 INSULATING GLASS PRODUCTS

A. Insulating Glass Manufacturers:

1. PPG Vitro Architectural Glass
2. AFG Industries, Inc.
3. Arch Aluminum and Glass
4. Guardian Industries Corp.
5. Viracon
6. Or Approved Equal.

B. Insulating Glass: ASTM E2190 certified by Insulating Glass Certification Council; with edge seal; purge interpane space with dry hermetic air.

1. Total Unit Thickness: 1 inch.
2. Insulating Glass Unit Edge Seal Construction: Manufacturer's standard.
3. Outer Pane: 1/4 inch thick tempered equal to Vitro Optiblu.
4. Air Space: 1/2 inch.
5. Inner Pane: 1/4 inch thick tempered equal to Vitro Solarban 60 (3) on clear.
6. Visible Light Trans. 51%.
7. Exterior Reflectance: 8
8. SHGC: 0.38
9. Winter U value English: 0.29

2.5 SECURITY INSULATING GLASS

A. Provide 3M security film to the number 4 (interior) surface.

2.6 SPANDREL GLASS

A. Provide a ceramic frit, silicone opacification or back paint in color as selected by the Architect.

2.7 GLASS FILM

A. Provide glass film applied to upper exterior gym windows. Provide 3M Fasara Chamonix applied as recommended by the Manufacturer.

2.8 GLAZING SEALANTS

A. Elastomeric Glazing Sealants: Materials compatible with adjacent materials including glass, laminated glass core, insulating glass seals, and glazing channels.

1. Silicone Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component; chemical curing; capable of water immersion without loss of properties; non-bleeding, non-staining, cured Shore A hardness of 15 to 25.
 - a. Color: As selected.
 - b. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

2. Polyurethane Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component, chemical curing, non-staining, non-bleeding, Shore A Hardness Range 20 to 35.
 - a. Color: As selected.
 - b. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- B. Dense Gaskets: Resilient extruded shape to suit glazing channel retaining slot; black.
 1. Neoprene: ASTM C864.
 2. EPDM: ASTM C864.
 3. Silicone: ASTM C1115.
- C. Soft Gaskets: ASTM C509; resilient extruded shape to suit glazing channel retaining slot; black.
 1. Neoprene.
 2. EPDM.
 3. Silicone.
- D. Pre-Formed Glazing Tape: Size to suit application.
 1. Preformed butyl compound 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
 - a. Butyl Corner Sealant: ASTM C920 single component non-skinning butyl compatible with glazing tape; color to match tape.
 - b. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
 2. Glazing Tape: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air barrier and vapor retarder seal.
 - a. Interior Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

2.9 GLAZING ACCESSORIES

- A. Setting Blocks: Elastomeric material recommended by glass manufacturer, 80 to 90 Shore A durometer hardness, length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Elastomeric material recommended by glass manufacturer, 50 to 60 Shore A durometer hardness, minimum 3 inch (75 mm) long x one half the height of glazing stop x thickness to suit application , self adhesive on one face.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings for glazing are correctly sized and within acceptable tolerance.
- B. Verify surfaces of glazing channels or recesses are clean, free of obstructions impeding moisture movement, weeps are clear, and ready to receive glazing.

3.2 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

- A. Perform installation in accordance with GANA Glazing Manual.
 - 1. Glazing Sealants: Comply with ASTM C1193.
 - 2. Fire Rated Openings: Comply with NFPA 80.
- B. Exterior Dry Method (Gasket Glazing):
 - 1. Cut glazing gasket to length; install on glazing pane. Seal corners by butting tape and sealing junctions with compatible butyl sealant.
 - 2. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.
 - 3. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
 - 4. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- C. Exterior Wet/Dry Method (Preformed Tape and Sealant) Installation:
 - 1. Cut glazing tape to length and set against permanent stops, 3/16 inch (5 mm) below sight line. Seal corners by butting tape and dabbing with compatible butyl sealant.
 - 2. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapor seal.
 - 3. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.
 - 4. Rest glazing on setting blocks and push against tape with sufficient pressure to attain full contact at perimeter of pane or glass unit.
 - 5. Install removable stops, with spacer strips inserted between glazing and applied stops, 1/4 inch (6 mm) below sight line
 - 6. Fill gap between glazing and stop with elastomeric glazing sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch (9 mm) below sight line.

7. Apply cap bead of elastomeric glazing sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

D. Exterior Wet Method (Sealant and Sealant) Installation:

1. Place setting blocks at 1/4 points and install glazing pane or unit.
2. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inches (600 mm) intervals, 1/4 inch (6 mm) below sight line.
3. Fill gaps between glazing and stops with elastomeric glazing sealant to depth of bite on glazing, but not more than 3/8 inch (9 mm) below sight line to ensure full contact with glazing and continue the air and vapor seal.
4. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

E. Exterior and Interior Butt Glazed Method (Sealant Only) Installation:

1. Temporarily brace glass in position for duration of glazing process. Mask edges of glass at adjoining glass edges and between glass edges and framing members.
2. Temporarily secure small diameter non-adhering foamed rod on back side of joint.
3. Apply sealant to open side of joint in continuous operation; thoroughly fill joint without displacing foam rod. Tool sealant surface smooth to concave profile.
4. Permit sealant to cure then remove foam backer rod. Apply sealant to opposite side, tool smooth to concave profile.
5. Remove masking tape.

F. Interior Wet/Dry Method (Tape and Sealant) Installation:

1. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.
2. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.
3. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
4. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch (600 mm) intervals, 1/4 inch (6 mm) below sight line.
5. Fill gaps between pane and applied stop with elastomeric glazing sealant to depth equal to bite on glazing, to uniform and level line.
6. Trim protruding tape edge.

G. Interior Wet Method (Compound and Compound) Installation:

1. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch (600 mm) centers, kept 1/4 inch (6 mm) below sight line.
2. Locate and secure glazing pane using spring wire clips or glazers' clips.
3. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.4 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass and adjacent surfaces.

END OF SECTION 08 8000

SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes metal stud wall framing; metal channel ceiling framing, special trim pieces; gypsum board and joint treatment.

1.2 REFERENCES

A. ASTM International:

1. ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
2. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
3. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
4. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
5. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
6. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
7. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing.
8. ASTM C1396 – Standard Specification for Gypsum Board.
9. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
10. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Gypsum Association:

1. GA 214 - Recommended Levels of Gypsum Board Finish.
2. GA 216 -Application and Finishing of Gypsum Board.
3. GA 600 - Fire Resistance Design Manual Sound Control.

C. Underwriters Laboratories Inc.:

1. UL - Fire Resistance Directory.

D. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.

- B. Shop Drawings: Indicate special details associated with fireproofing, acoustic seals, and trim.
- C. Product Data: Submit data on metal framing, gypsum board, joint tape; and trim.
- D. Evaluation Reports: Submit evaluation reports certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS accreditation criteria for inspection agencies.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840, ASTM C1280, GA-214, GA-216 and GA-600.
- B. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the Steel Framing Industry Association (SFIA) or a similar organization that provides a verifiable code compliance program.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202 "Code of Standard Practice."

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.
- C. Design framing systems in accordance with ASTM C645.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Steel Framing Manufacturers:
 - 1. ClarkDietrich.
 - 2. MarinoWare.
 - 3. MBA Building Supplies.
- B. Gypsum Board and Related Product Manufacturers:
 - 1. CertainTeed Gypsum
 - 2. G-P Gypsum Corp.
 - 3. Lafarge.
 - 4. National Gypsum Co.

5. United States Gypsum Co.

2.2 COMPONENTS

- A. Framing Materials, General: Comply with ASTM C645, AISI S220 and ASTM C645, Section 10, AISI S220 for conditions indicated.
 - 1. Protective Coating: Comply with ASTM C645; ASTM A653/A653M, G40 (Z120) or coating with equivalent corrosion resistance of ASTM A653/A653M, G40 (Z120). Galvannealed products are not acceptable.
 - a. Coating: ClarkDietrich; DiamondPlus® Coating, or comparable.
 - 1) Coating roll-formed from steel complying with mechanical and chemical requirements of ASTM A1003 with a zinc-based coating.
 - b. Coatings shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- B. Studs and Tracks:
 - 1. Typical Locations: ASTM C645; galvanized sheet steel, 20 gauge (0.0296 inch) minimum thick, C shape.
 - 2. Locations receiving abuse resistant gypsum panels, high impact resistant panels or exterior sheathing shall be 20 gauge (0.0296 inch) minimum thickness.
- C. Equivalent Gauge Studs and Tracks:
 - 1. ClarkDietrich; ProSTUD 20 (20EQ) and ProTRAK 20 (20EQ) with Smart Edge technology or comparable product.
 - 2. Minimum Base-Steel Thickness: 0.0181 inch (0.4597 mm).
 - 3. Equivalent Gauge Thickness ("EQ") Steel Studs and Runners: Members that can show certified third-party testing with gypsum board in accordance with ICC-ES AC86 (Reapproved August 2015) need not comply with minimum thickness limitation or minimum section properties set forth in ASTM C645. Submission of an evaluation report is acceptable to show compliance with this requirement.
- D. Furring, Framing, and Accessories: ASTM C645.
 - 1. ClarkDietrich; Hat-Shaped, Rigid Furring Channels, or comparable product.
 - a. Minimum Base-Steel Thickness: 0.0179 inch (0.45 mm).
 - 2. Fasteners: ASTM C1002.
 - 3. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- E. Gypsum Board Materials:

1. Standard Gypsum Board: ASTM C1396; 5/8 inch thick, maximum available length in place; ends square cut, tapered edges.
2. Fire Rated Gypsum Board Type X: ASTM C1396; fire resistive type, UL or WH rated; 5/8 inch thick, maximum available length in place; ends square cut, tapered edges.
3. Moisture Resistant Gypsum Board: ASTM C630; 5/8 inch thick, maximum available length in place; ends square cut, tapered edges.

2.3 ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced, thickness to match stud depth.
- B. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board; manufactured by Pecora, USG or ChemRex.
- C. Comer Beads: Metal.
- D. Edge Trim: Type U exposed reveal bead.
- E. Special Trim Pieces, Expansion Joints and Reveals: As manufactured by Fry Reglet to suit installation as indicated on the drawings.
- F. Joint Materials:
 1. Typical: ASTM C475; reinforcing tape, joint compound, adhesive, and water.
 2. For abuse resistant gypsum panels, high impact resistant panels or exterior sheathing use sheetrock joint tape and sheetrock setting type (Durabond 45 or 90) or lightweight setting-type (Easy Sand 45 or 90) joint compound as manufactured by United States Gypsum Co. Follow manufacturer's recommendations for each application.
 3. For mold resistant gypsum board use joint materials as recommended by the Manufacturer.
- G. Fasteners: ASTM C1002, Type S12 for steel studs.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

- A. Metal Stud Installation:
 1. Install studs in accordance with ASTM C754 and the Manufacturer's instructions.
 2. Metal Stud Spacing: 16 inches on center.

GYPSUM BOARD ASSEMBLIES

3. Refer to Drawings for indication of partitions extending stud framing through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
 4. Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.
 5. Blocking: Bolt or screw steel channels to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, wood frame opening, toilet accessories, hardware, and all other items indicated on the drawings to attach to the wall.
- B. Wall Furring Installation:
1. Erect wall furring for direct attachment to concrete masonry and concrete walls.
 2. Erect furring channels vertically; space maximum 16 inches oc, not more than 4 inches from floor, ceiling lines and abutting walls.
 3. Install thermal insulation between Z-furring channels directly attached to concrete masonry and concrete walls.
- C. Furring For Fire Ratings: Install furring as required for fire resistance ratings indicated.
- D. Ceiling Framing Installation:
1. Install in accordance with ASTM C754.
 2. Coordinate location of hangers with other work.
 3. Install ceiling framing independent of walls, columns, and above ceiling work.
 4. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
 5. Laterally brace entire suspension system.
- E. Acoustic Accessories Installation:
1. Install resilient channels at maximum 24 inches on center. Locate joints over framing members.
 2. Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
 3. Install acoustic sealant within partitions.
- F. Gypsum Board Installation:
1. Install gypsum board in accordance with GA-216 and GA-600.
 2. Erect single layer standard gypsum board vertical, with ends and edges occurring over firm bearing.
 3. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.

4. Erect exterior gypsum sheathing in accordance with ASTM C1280, horizontally, with edges butted and ends occurring over firm bearing.
5. Use screws when fastening gypsum board to metal furring or framing.
6. Double Layer Applications: Use gypsum backing board for first layer, placed perpendicular to framing or furring members. Use fire rated gypsum backing board for fire rated partitions and ceilings.
7. Double Layer Applications: Secure second layer with fasteners.
8. Place second layer perpendicular to first layer. Offset joints of second layer from joints of first layer.
9. Use moisture resistant gypsum board in all restrooms, kitchens or similar wet areas. Treat cut edges and holes in moisture resistant gypsum board with sealant.
10. Place control joints consistent with lines of building spaces. Distance between control joints shall not to exceed 30 ft.
11. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
12. Install cementitious backing board over metal studs.
13. Apply gypsum board to curved walls in accordance with GA-216.

G. Joint Treatment:

1. Finish in accordance with GA-214 Level 4 or Level 5 for walls exposed to critical lighting.
2. Fill and finish joints and corners of cementitious backing board.

3.3 ERECTION TOLERANCES

- A. Division 01 - Quality Requirements: Tolerances.
- B. Maximum Variation of Finished Gypsum Board Surface from Flat Surface: 1/8 inch in 10 feet.

3.4 SCHEDULES

- A. Finishes in accordance with GA-214 Level:
1. Level 1: Above finished ceilings concealed from view unless a higher level of finish is required for fire-resistance-rated assemblies.
 2. Level 4: Walls exposed to view.
 3. Level 4: Ceilings exposed to view.
 4. Level 5: All walls exposed to critical lighting.

END OF SECTION 09 2116

SECTION 09 5100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Sections include suspended metal grid ceiling system, perimeter trim, acoustic panels.
- B. Section includes re-working all existing acoustical ceilings disturbed by construction to match existing.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 2. ASTM C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - 3. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 4. ASTM E580 - Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
 - 5. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.
- B. Ceilings and Interior Systems Construction Association:
 - 1. Cisca - Acoustical Ceilings: Use and Practice.
- C. Underwriters Laboratories Inc.:
 - 1. UL - Fire Resistance Directory.

1.3 PERFORMANCE REQUIREMENTS

- A. Suspension System: Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1: 240.

1.4 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system and wall layouts. Indicate method of suspension where interference exists.

- C. Product Data: Submit data on metal grid system components, acoustic units and accessories.
- D. Samples: Submit two full size samples illustrating material and finish of acoustic units.
- E. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, perimeter molding and hold down clips.
- F. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

- A. Conform to CISCA requirements.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.
- C. Provide seismic design of suspended ceiling under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements.
- B. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustic unit installation.

1.8 SEQUENCING

- A. Sequence Work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Install acoustic units after interior wet work is dry.

1.9 EXTRA MATERIALS

- A. Division 01 - Execution Requirements: Spare parts and maintenance products.
- B. Furnish 10 percent of total acoustic unit area of extra panels to Owner.

PART 2 PRODUCTS

2.1 ACOUSTICAL PANELS

A. Type A

1. Acceptable Manufacturer/Product:
 - a. Armstrong; Fine Fissured with HumiGuard Plus and BioBlock.
 - b. Certaineed; Fine Fissured with BioShield HHF-157.
 - c. USG; Radar ClimaPlus mold/mildew retardant.
2. Size: 24 x 24 inches.
3. Thickness: 5/8 inches.
4. Light Reflectance: Not less than 0.80.
5. NRC: Not less than 0.50.
6. CAC: Not less than 30.
7. Edge: Square.
8. Surface Color: White.
9. Locations: Typical.

B. Type B

1. Acceptable Manufacturer/Product:
 - a. Armstrong; Clean Room VL
 - b. CertainTeed; VinylShield A
2. Size: 24 x 24 inches.
3. Locations: Restrooms.

2.2 GRID

A. Acceptable Manufacturers:

1. Armstrong.
2. USG.
3. Chicago Metallic.
4. Certaineed.

B. Non-fire Rated Grid: ASTM C635, intermediate duty; exposed T as indicated; components die cut and interlocking.

2.3 ACCESSORIES

- A. Acoustic Sealant For Perimeter Moldings: Acoustical sealant by USG or Pecora.
- B. Touch-up Paint: Type and color to match acoustic and grid units.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.

- B. Verify layout of hangers will not interfere with other work.

3.2 EXISTING WORK

- A. Extend existing acoustical ceiling installations using materials and methods as specified.
- B. Clean and repair existing acoustical ceilings which remain or are to be reinstalled.

3.3 INSTALLATION

A. Lay-In Grid Suspension System:

1. Install suspension system in accordance with ASTM C636 and as supplemented in this section.
2. Install system in accordance with ASTM E580.
3. Install system capable of supporting imposed loads to deflection of 1/240 maximum.
4. Locate system on room axis according to reflected plan.
5. Install after major above ceiling work is complete. Coordinate location of hangers with other work.
6. Install hanger clips during steel deck erection. Install additional hangers and inserts as required.
7. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
8. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers and related carrying channels to span extra distance.
9. Do not support components on main runners or cross runners when weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
10. Do not eccentrically load system or produce rotation of runners.
11. Perimeter Molding:
 - a. Install edge molding at intersection of ceiling and vertical surfaces into bed of acoustic sealant.
 - b. Use the longest practical lengths.
 - c. Miter corners.
 - d. Install at junctions with other interruptions.
12. Form expansion joints. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.
13. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with UL assembly requirements and light fixture ventilation requirements.

B. Acoustic Units:

1. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

2. Lay directional patterned units one way with pattern parallel to longest room axis. Fit border trim neatly against abutting surfaces.
3. Install units after above ceiling work is complete.
4. Install acoustic units level, in uniform plane, and free from twist, warp, and dents.
5. Cutting Acoustic Units:
 - a. Cut to fit irregular grid and perimeter edge trim.
 - b. Cut reveal edges to field cut units.
 - c. Double cut and field paint exposed edges of tegular units.
6. Where bullnose concrete block corners or round obstructions occur, install preformed closures to match perimeter molding.
7. Lay acoustic insulation for distance of 48 inches on both sides of acoustic partitions.
8. Install hold-down clips to retain panels tight to grid system within 20 ft of exterior door.

3.4 ERECTION TOLERANCES

- A. Division 01 - Quality Requirements: Tolerances.
- B. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- C. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION 09 5100

SECTION 09 6500 - RESILIENT FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Resilient base.

1.2 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
3. ASTM F1861 - Standard Specification for Resilient Wall Base.

1.3 PERFORMANCE REQUIREMENTS

A. Conform to applicable code for fire performance ratings.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Samples:

1. Submit manufacturer's complete set of color samples for initial selection.
2. Submit two samples, for product specified.

D. Test Results: Submit moisture test results before starting installation.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Protect roll materials from damage by storing on end.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements.
- B. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (32 degrees C).
- C. Store materials for not less than 48 hours prior to installation in area of installation at temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

1.9 EXTRA MATERIALS

- A. Division 01 - Execution Requirements: Spare parts and maintenance products.
- B. Furnish 100 sq ft of flooring, 30 lineal feet of base, and 5 percent of installed stair materials of each type and color specified.

PART 2 PRODUCTS

2.1 RESILIENT BASE

- A. Manufacturers:
 - 1. Refer to the Room/Material Finish Schedule.
- B. Base: ASTM F1861 Rubber; top set coved:
 - 1. Height: 4 inch.
 - 2. Thickness: 0.125 inch thick.
 - 3. Length: Roll.
 - 4. Accessories: Premolded end stops.

2.2 ACCESSORIES

- A. Primers and Adhesives: High Moisture types recommended by flooring manufacturer.
- B. Moldings and Edge Strips: Same material as flooring manufactured by Roppe or Johnsonite.

- C. Surface Treatment: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Project Management and Coordination: Verification of existing conditions before starting Work.
- B. Clear surfaces free of substances capable of impairing adhesion of moisture barrier. Shot blast if required.

3.2 PREPARATION

- A. Clean substrate.
- B. Apply primer as required to prevent "bleed-thru" or interference with adhesion by substances cannot be removed. Apply primer to surfaces as recommended by the flooring manufacturer.

3.3 INSTALLATION - BASE

- A. Fit joints tightly and make vertical.
- B. Miter internal corners. At external corners, "V" cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.4 CLEANING

- A. Division 01 - Execution Requirements: Final cleaning.
- B. Remove excess adhesive from floor, base, and wall surfaces without damage.
- C. Clean and maintain resilient flooring products.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Division 01 - Execution Requirements: Protecting installed construction.

3.6 SCHEDULE

- A. See Room Finish Schedule.

END OF SECTION 09 6500

SECTION 09 6740 - EPOXY FLOORING

1.0 GENERAL

1.01 WORK INCLUDED

- A. Preparation of slabs.
- B. Provide labor, equipment and materials to complete interior floor and base coatings as indicated on the drawings and as specified herein.

1.03 QUALITY ASSURANCE

- A. References: Cited Standards are incorporated herein by reference and govern the work:
 - 1. Pamphlet No. 03732, International Concrete Repair Institute (Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer Overlays.
- B. Single Source Responsibility-Obtain primary resinous floor materials including hardening agents, finish or sealing coats from a single manufacturer with not less than 5 years of successful experience in manufacturing and installing the principal materials described in this section. Provide secondary materials only of type and from a source recommended by the manufacturer of the primary material.
- C. Contractor Experience: Furnish list of projects using materials specified for this project that applicator has furnished during the past five years. Include the Following:
 - 1. Letter of training certification from the manufacturer/distributor stating that contractor is an approved installer of the products specified in this Section.
 - 2. Submit written description of experience with specified material over the last 5 years. Include job size (in square feet) and complexity of projects. List a minimum of ten projects with different Owners giving contact names and phone numbers.
 - 3. Submit resumes on key personnel who will be performing the actual work.
- D. Sampling of material:
 - 1. When directed by Architect/Engineer obtain test samples from material stored at the project site or source of supply.
 - 2. Select samples at random from sealed containers.
- E. Manufacturer Supervision:

1. A representative of the materials manufacturer must be present on site for the duration of the preparation and for all phases of the installation of the specified coating materials.

1.04 SUBMITTALS and PRE-APPROVAL

- A. Submit three (3) copies of manufacturer's product literature indicating technical data. If different than the product basis of design, product data sheets must be submitted 10 days prior to bid date for architect's approval subject to performance criteria in paragraph 2.01 E "Product Characteristics".
- B. Submit three (3) copies of manufacturer's installation and application guide.
- C. Submit three (3) samples of finished product on 12 inch by 12 inch (12" x 12") substrate on which product is to be applied.
 1. Prepare samples on each type of material to be surfaced.
 2. Make samples not more than one and a half (1½") inches thick.
 3. Submit samples in accordance with Division 01.
 4. Test Results: Submit moisture test results before starting installation.
- D. Submit three (3) copies of manufacturer's Material Safety Data Sheets.
- E. Submit a list of ten (10) projects of similar complexity and size as this project including Owner's names with phone numbers. References must be submitted 10 days prior to bid date for approval by architect.

Note: Bidders are encouraged to submit materials that meet the Basis of Design. In order to have a material accepted as a Pre- Approved Material for the work outlined herein the items listed in this section 1.04 A-E must be received by the architect for evaluation and approval no less than 14 days prior to the original published bid date. Approved Materials will be by Addendum only, 7 days prior to original published bid date. Submittals circumventing this process will not be approved and will not be acceptable for inclusion in this project.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of materials:
 1. Deliver materials to project site with labels legible and intact.
- B. Storage of materials:
 1. Store only acceptable project materials on site.
 2. Store in suitable location convenient to progress of work.
 3. Components of flooring system, flakes to be broadcast therein, and equipment necessary to surface preparation, system installation, final glazing and clean up.
 4. Comply with health and fire regulations.

5. Storage temperature shall be between 40° F and 90° F or such other ambient temperature conditions as may be specifically recommended by product manufacturer.

1.06 JOB CONDITIONS

A. Environmental requirements:

1. Comply with manufacturer's recommendations as to environmental conditions under which floor-coating systems can be applied. Surfaces to be coated and ambient air temperature shall be between 70° F and 90° F. Do not apply flooring system at temperatures beyond those limits stated in the manufacturer's technical data sheet unless given written permission by the manufacturer.
2. Do not apply flooring system in areas where dust or other airborne particulate matter is being generated.

B. Protection:

1. Cover or otherwise protect finished work of other trades and surfaces not being coated concurrently or not to be coated.

2.00 PRODUCTS

2.01 MATERIALS

- A. Basis of Design: Prime Coat's Micro-Chip Hybrid System as manufactured by Prime Coat Coating Systems Waukegan, IL (877-362-5111) PC Prime Cast 2611 (products include PC 320, PC 327MC, PC 440).

1. Dura-A-Flex Hybri-Flex EC
2. Stonhard HT Primer with Tectop EF
3. Tnemec Deco-Fleck.
4. Florock
5. General Polymers by Sherwin Williams.

- B. Selected high performance floor coating system shall be applied over cured concrete slabs on grade, prepared to a profile as recommended by the selected manufacturer. Prior to system application, the concrete surface shall be free of laitance, form release agents, curing agents, oil, grease and other contaminants. Surface shall be free of fins, projections, and loosely adhering concrete, dirt and dust particles.

- C. Secure written consent of Architect/Engineer prior to placing the proposed product specified in 2.01 (a) above.

- D. Include on Labels of Containers:

1. Manufacturer's name.
2. Product name.

3. Product number.
4. Color.
5. Instructions for reducing, where applicable.
6. Component description.

E. Product Characteristics – Flake-filled Epoxy Floor Coating.

Performance Criteria: Flake-filled epoxy coating system shall meet or exceed the following requirements:

1. Compressive Strength: 12,400 psi after 7 days (ASTM C-579).
2. Tensile Strength: 2,200 psi (ASTM C-307).
3. Flexural Strength: 4,800 psi (ASTM C-307).
4. Bond Strength: >400 psi or 100% concrete failure (ASTM D-4541).
5. Indentation: No indentation (MIL-D-3134F).
6. Abrasion Resistance: 0.04 gm. max weight loss (ASTM D-4060, Taber Abrader).
7. Hardness: 85-90 (ASTM D-2240/Shore D Durometer).
8. Flammability: Self-extinguishing. Extent of burning 0.25 inches max. (ASTM D-635).
9. Thermal Coefficient of Linear Expansion: 3.5×10^{-5} C (ASTM E-831).
10. Water Absorption: 0.1% (ASTM C-413).
11. Heat Resistance Limitation: For continuous exposure: 140 degrees F/60 degrees C. For intermittent spills: 200 degrees F/93 degrees C.

F. Product Composition:

1. All coatings used must be 100% solids.
2. Use only manufacturer's best grade ultra clear ultra-violet non yellowing finish coat material.

G. Moisture Barrier: Mapei Planiseal VS Fast or equal product as recommended by the flooring manufacturer.

2.02 COLORS

- A. Colors shall be selected by the Architect/Engineer from Manufacturer's standard palette of not less than twelve (12) colors. Not more than three (3) colors will be selected for this project.

2.03 MIXING

- A. Accomplish job mixing and application only when acceptable to the Architect/Engineer.
- B. Mix components only in containers furnished by the manufacturer.
- C. Proportioning of two-part and three-part coatings shall be in strict accordance with methods recommended by the manufacturer.
- D. Prime coat shall be mixed using a variable speed drill with a PS Jiffy blade.

Parts A and B shall be mixed a minimum of two minutes. Ensure full blending of both parts with all material measured into the mixing container. Apply the mixed material within the pot life and temperatures recommended by the manufacturer.

- E. Intermediate coats (not less than two (2)) shall be mixed similar to that method employed for the prime coat.
- F. Glaze coat, consisting of Parts A and B, shall be mixed for a minimum of two minutes using a variable speed drill with a PS Jiffy blade.
- G. For all mixing operations, the flooring system components shall be considered as hazardous materials. Read and observe container label warnings and Material Safety Data Sheets for health and safety information prior to starting mixing operations.
- H. Do not reseal mixed material. Permit final chemical set to occur in the container and when set has been achieved; dispose of hardened material by legal means.
- I. Do not apply any material that has exceeded shelf and pot life as determined by manufacturer.

3.0 EXECUTION

3.01 INSPECTION

- A. Test concrete floors for moisture content, negative alkalinity, carbonization and dusting. Report results to Architect.
- B. Clean surfaces free of substances capable of impairing adhesion of moisture barrier. Shot blast if required.

3.02 PREPARATION OF SURFACES

- A. New concrete floor slabs on grade.
 - 1. Smooth troweled dense finish concrete, which shall have been properly cured not less than twenty-eight (28) days after placement.
 - 2. Employ a radio frequency moisture meter to determine that residual uncombined moisture content of concrete slab is less than five (5) percent by weight. Conduct ASTM F 1869 to further record the Moisture Vapor Emission Rate. If floor slabs exceed 5 percent moisture content or 3 pounds per 1,000 square feet per 24 hours, install Mapei Planiseal EMB or equal product per the manufacturer's instructions.
- B. Old concrete floor slabs on grade.
 - 1. Employ a radio frequency moisture meter to determine that residual uncombined moisture content of concrete slab is less than five (5) percent by weight. Conduct ASTM F 1869 to further record the Moisture Vapor Emission Rate. If floor slabs exceed 5 percent moisture content or 3

pounds per 1,000 square feet per 24 hours, install Mapei Planiseal EMB per the manufacturer's instructions.

3.03 APPLICATION

A. General Requirements:

1. Do not apply initial coating until Mapei moisture barrier has cured.
2. Apply PC 320 at a rate of one (1) gallon per 160 square feet of floor surface or approximately 10 mils wet film thickness. After applying primer/broadcast coat, broadcast onto the liquid surface PC 327 MC colored micro-fleck to rejection. Remove excess micro-fleck after film is dried by broom sweeping or industrial grade vacuum. A total dry film thickness of the intermediate coat shall be not less than forty (20.0) mils including encapsulated micro-flecks.
3. When the intermediate coat has cured and excess aggregate thoroughly removed, apply PC 440 UV clear to a dry film thickness of 10.0 mils. After the first clear coat is fully cured, apply a second coat of PC 440 UV clear with PC 499 Anti-Microbial additive. Finish coats may be installed with a brush, roller or airless sprayer. The finished floor must meet ADA specifications for this project. Use a Sullmair FSC 2000-1346 Floor tester to validate ADA requirements. Please note to achieve the required ADA coefficient of friction, additional topcoat material or anti-slip additives may be necessary. A total DFT of the micro-flake broadcast system shall be a minimum 40 mils thick.
4. Keep all application equipment free from contaminates and suitable for the finish required.
5. Comply with recommendations of manufacturer of high performance floor system for drying time between prime and succeeding coats.
6. Finished product shall be uniform in color and texture and free of skipped or missed areas.
7. Where walls and floors abut and are both of a resinous material, obtain all coating materials from a single manufacture being sure to meet all re-coat windows to insure a seamless installation.

B. Inspections:

1. Architect/Engineer shall inspect all work of this section for procedural, visual and textural acceptability.
2. Refinish areas where portion of finish has been damaged or is not acceptable.

C. Finished Work:

1. Coating contractor to protect finished work from damage by covering with card board sheets.

3.04 CLEANING

- #### A.
- Remove debris promptly from work area and dispose of properly.

- B. Remove spilled, splashed or splattered coating materials from all surfaces.
- C. Do not mar surface finish of items being cleaned.

3.05 FLOOR FINISH SCHEDULE

- A. Apply high performance floor system finish to all floor areas shown on the drawings or specified in the room finish schedule.
- B. Where base finish is to be installed, provide base profiles as shown and detailed in the drawings and as specified in the room finish schedule.
- C. Unless directed by the contract documents do not install high performance floor coatings on:
 - 1. Ferrous metals installed in concrete slabs.
 - 2. Non-ferrous metals installed in or adjacent to concrete slabs.
 - 3. Pipe, conduit, floor drains, insulated conductors, or other electrical, mechanical or process-related equipment.

3.06 GUARANTY/WARRANTY

- A. Provide Owner, through Architect/Engineer, with an acceptable form of warranty against defects in material or workmanship for a period of one (1) year from date of substantial completion.
- B. Issuance of warranty shall be a condition precedent to receipt of final payment by the high performance flooring system contractor.
- C. Extent of warranty shall be limited to the repair or replacement of defective surfaces at no cost to the Owner, and for any damage directly resulting from such defects during the warranty period. The warranty shall not include any remedy for defects caused by abuse.

END OF SECTION 09 6740

SECTION 09 9100 - PAINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and field application of paints and coatings as indicated.
- B. Work includes all painting and finishing of interior and exterior exposed items and surfaces, throughout project, except as otherwise indicated.
 - 1. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified as work of other sections.
- C. Work includes field painting of exposed bare and covered pipes and ducts, and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated.
- D. "Paint" as used herein means all coating systems materials including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as primer, intermediate or finish coats.
- E. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, the Architect will select these from manufacturer's standard range of colors or finishes.
- F. Sheen to specific applications is as follows:
 - 1. Flat (0-10)
 - 2. Eggshell (10-20)
 - 3. Satin (20-40)
 - 4. Semi-Gloss (45-65)
 - 5. Gloss (75+)

1.2 RELATED WORK NOT INCLUDED

- A. Pre-finished Items: Unless otherwise indicated, do not include painting when factory finishing or Installer-finishing is specified for such items as (but not limited to) metal toilet partitions, pre-finished partition systems, acoustic materials, pre-finished casework, elevator entrance doors and frames, elevator equipment, and finished mechanical and electrical equipment, including light fixtures, switchgear and distribution cabinets.
- B. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible

areas, foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.

- C. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.
- D. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts will not require finish painting.
- E. Shop Priming: Unless otherwise indicated, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metal work and similar items.
- F. Do not paint over any code required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
 - 2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
- B. Painting and Decorating Contractors of America:
 - 1. PDCA - Architectural Painting Specification Manual.
- C. SSPC: The Society for Protective Coatings:
 - 1. SSPC - Steel Structures Painting Manual.

1.4 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.

1.5 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on all finishing products.
- C. Samples:
 - 1. Submit two paper chip samples, illustrating range of colors and textures available for each surface finishing product scheduled.

2. Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on, 8-1/2 x 11 inch in size.

- D. Manufacturer's Installation Instructions: Submit special surface preparation procedures, substrate conditions requiring special attention, and conditions.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 MOCKUP

- A. Division 01 - Quality Requirements: Mock-up requirements.
- B. Construct mockup panel, 8 feet tall by 8 feet wide, illustrating coating color, texture, and finish.
- C. Locate where directed.
- D. Incorporate accepted mockup as part of Work.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

- C. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum Application Temperature for Varnish and Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candle (860 lx) measured mid-height at substrate surface.

1.11 EXTRA MATERIALS

- A. Supply 2 gallons (8 L) of each color, type, and surface texture; store where directed.
- B. Label each container with color, type, texture, room locations, and in addition to manufacturer's label.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

- A. Manufacturers:
 - 1. Benjamin Moore & Co.
 - 2. PPG Architectural Finishes, Inc.
 - 3. Sherwin-Williams.

2.2 COMPONENTS

- A. Coatings: Ready mixed, except field catalyzed coatings. Prepare coatings:
 - 1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
 - 2. For good flow and brushing properties.
 - 3. Capable of drying or curing free of streaks or sags.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified; commercial quality.
- C. Patching Materials: Latex filler.
- D. Fastener Head Cover Materials: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify surfaces and substrate conditions are ready to receive Work as instructed by product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.
- C. Test shop applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Plaster and Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 5. Concrete Floors: 8 percent.

3.2 PREPARATION

- A. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Surfaces: Correct defects and clean surfaces capable of affecting work of this section. Remove or repair existing coatings exhibiting surface defects.
- C. Marks: Seal with shellac those which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- F. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- G. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- I. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate; rinse well and

allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

- J. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- K. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- L. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
- M. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- N. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
- O. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior paintable caulking compound after prime coat has been applied.
- P. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.
- Q. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
- R. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

- A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- B. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
- C. Sand wood and metal surfaces lightly between coats to achieve required finish.
- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

- E. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.
- F. Prime concealed surfaces of interior and exterior woodwork with primer paint.
- G. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.
- H. Finishing Mechanical and Electrical Equipment:
 - 1. Paint shop primed equipment.
 - 2. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 - 3. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, and except where items are shop finished.
 - 4. Paint interior surfaces of air ducts and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
 - 5. Paint exposed conduit and electrical equipment occurring in finished areas.
 - 6. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
 - 7. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
 - 8. Paint tanks, heat exchangers, ductwork and insulation, motors and accessories.

3.4 CLEANING

- A. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

3.5 SCHEDULE - SHOP PRIMED ITEMS FOR SITE FINISHING

- A. Metal Fabrications (Section 05 5000): Exposed surfaces of lintels, elevator pit ladders, access ladders, and handrails.

3.6 SCHEDULES OF PAINT PRODUCTS

- A. All paints and related products are to be the best in quality for each application designated. If technology and products have been developed or upgraded, the Contractor shall include in his original cost the best product from each manufacturer for the application specified. No cost increases will be accepted for failure to include the best in quality for each application.
- B. Existing Surfaces: The Contractor shall examine the existing surfaces of the project and include the proper primer in his original cost. No cost increases will be accepted for failure to examine existing surfaces and include the proper primer.

3.7 SCHEDULE - EXTERIOR SURFACES

A. Wood - Painted (Opaque):

1. One coat of latex or alkyd primer sealer.
 - a. Sherwin Williams Exterior Latex Wood Primer B42 Series
2. Two coats of alkyd or latex enamel, gloss.
 - a. Sherwin Williams A-100 Exterior Latex Gloss A8 Series

B. Wood - Transparent:

1. Two coats of stain.
 - a. Sherwin Williams Woodscapes Exterior Semi-Transparent Polyurethane Stain A15T5

C. Glue-Laminated Wood and Wood Timber Members:

1. Two coats of stain.
 - a. Sherwin Williams Woodscapes Exterior Semi-Transparent Polyurethane Stain A15T5

D. Concrete, Cement Plaster & Masonry other than concrete masonry units:

1. One coat of block primer.
 - a. Sherwin Williams Loxon Masonry Primer A24 Series
2. Two coats of latex or alkyd, flat.
 - a. Sherwin Williams A-100 Exterior Flat A6 Series

E. Concrete Masonry Units:

1. Filler coat:
2. Sherwin Williams Heavy Duty Blockfiller B42W46 Two coats of latex or alkyd, flat.
 - a. Sherwin Williams A-100 Exterior Latex Flat A6 Series

F. Steel - Unprimed:

1. One coat of latex or alkyd primer.
 - a. Sherwin Williams Pro Industrial Pro -Cryl Acrylic Primer B66 Series
2. Two coats of alkyd or latex enamel, gloss.
 - a. Sherwin Williams Sher-Cryl High Performance Acrylic Coating B66 Series

G. Steel - Shop Primed:

1. Touch-up with Anti-Corrosive Primer
2. Sherwin Williams Pro Industrial Pro-Cryl Acrylic Primer B66 Series Two coats of alkyd or latex enamel, gloss.
 - a. Sherwin Williams Sher-Cryl High Performance Acrylic Coating B66 Series

H. Steel - Galvanized:

1. One coat galvanize primer.
 - a. Sherwin Williams Pro Industrial Pro-Cryl Primer B66 Series
2. Two coats of alkyd or latex enamel, gloss.
 - a. Sherwin Williams Sher-Cryl High Performance Acrylic Coating B66 Series

I. Aluminum - Mill Finish:

1. One coat primer.
2. Sherwin Williams Pro Industrial Pro-Cryl Primer B66 SeriesTwo coats of alkyd enamel, gloss.
 - a. Sherwin Williams Sher-Cryl High Performance Acrylic Coating B66 Series

3.8 SCHEDULE - INTERIOR SURFACES

A. Wood - Painted:

1. One coat of latex or alkyd prime sealer.
 - a. Sherwin Williams Premium Wall and Wood Primer B28 Series
2. Two coats of alkyd or latex enamel, semi-gloss.
 - a. Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series

B. Wood - Transparent:

1. Two coats of stain.
 - a. Sherwin-Williams Wood Classics 250Interior Wood Stain A49 Series
2. One coat sealer.
 - a. Sherwin Williams Wood Classics Waterborne Polyurethane A68 Series
3. Two coats of varnish, gloss or satin.
 - a. Sherwin Williams Wood Classics Waterborne Polyurethane A68 Series

C. Glue-Laminated Wood Members:

1. One coat of stain.
 - a. Sherwin Williams Wood Classics 250 Interior Wood Stain A49 Series Sherwin Williams Wood Classics Waterborne Polyurethane A68 Series

D. Concrete, Cement Plaster or Masonry other than Concrete Masonry Units:

1. One coat of primer sealer latex or alkyd.
 - a. Sherwin-Williams Loxon Concrete and Masonry Primer B28 Series
2. Two coats of latex or alkyd satin.

- a. Sherwin-Williams ProMar 200 Zero VOC Interior Latex Low Sheen B24-2600 Series
- E. Concrete Masonry Units:
 - 1. Filler coat:
 - a. Sherwin Williams Interior/Exterior Blockfiller B25W25
 - 2. Two coats of latex or alkyd, satin.
 - a. Sherwin Williams ProMar 200 Zero VOC Interior Latex Eg-Shel B20-2600 Series
- F. Steel - Unprimed:
 - 1. One coat of alkyd or latex primer.
 - a. Sherwin Williams ProIndustrial Pro Cryl Primer B66 Series
 - 2. Two coats of alkyd or latex enamel, semi-gloss.
 - a. Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series
- G. Steel - Primed:
 - 1. Touch-up with alkyd or latex primer.
 - a. Sherwin Williams Pro Industrial Pro Cryl Primer B66 Series
 - 2. Two coats of alkyd or latex enamel, semi-gloss.
 - a. Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series
- H. Steel - Galvanized:
 - 1. One coat galvanize primer.
 - a. Sherwin Williams Pro Industrial Pro Cryl Primer B66 Series
 - 2. Two coats of alkyd or latex enamel, semi-gloss.
 - a. Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series
- I. Aluminum - Mill Finish:
 - 1. One coat primer:
 - a. Sherwin Williams Pro Industrial Pro Cryl Primer B66 Series
 - 2. Two coats of latex enamel, gloss.
 - a. Sherwin Williams DTM Acrylic Gloss Coating B66 Series
- J. Concrete Floors:
 - 1. One coat of alkali resistant catalyzed epoxy primer.
 - a. Sherwin Williams armor Seal Floor Plex 7100 B70W410
 - 2. One coat of catalyzed epoxy enamel, semi-gloss
 - a. Sherwin Williams Armor Seal Floor Plex 7100 B70W400
- K. Gypsum Board and Plaster Walls and Ceilings:

1. One coat of latex primer sealer.
 - a. Sherwin Williams Pro Green 200 Latex Primer B28W600
2. Two coats of latex enamel, satin.
 - a. Sherwin Williams ProMar 200 Zero VOC Interior Latex Eg-Shel B20-2600 Series

3.9 SCHEDULE - COLORS

- A. See Room Finish Schedule.

END OF SECTION 09 9100

SECTION 10 1100 - VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes markerboards and tackboards.
- B. Section includes tack strips.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A135.4 - Basic Hardboard.
 - 2. ANSI A208.1 - Mat-Formed Wood Particleboard.
- B. ASTM International:
 - 1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. Federal Specification Unit:
 - 1. FS CCC-W-408 - Wall Covering, Vinyl-Coated.
 - 2. FS L-P-1040 - Plastic Sheets and Strips (Polyvinyl Fluoride).

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate wall elevations, dimensions, and joint locations, and special anchor details.
- C. Product Data: Submit data on markerboards, tackboards, tackboard surface covering, trim and accessories.
- D. Samples: Submit two 4 x 6 inch in size illustrating materials and finish, color and texture of markerboard, and trim, tackboard, and tackboard surfacing.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit Operation and Maintenance Data.

1.5 QUALITY ASSURANCE

- A. Conform to applicable code for flame/smoke rating of 0/25 for vinyl fabric covered tackboards in accordance with ASTM E84.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 WARRANTY

- A. Division 01 - Execution Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for visual display boards.
- C. Warranty: Include coverage of chalkboard and markerboard surface from discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.1 VISUAL DISPLAY BOARDS

- A. Manufacturers:
 - 1. Cig-Jan Products, Inc.
 - 2. Claridge Products and Equipment.
 - 3. Ghent Manufacturing Inc.
 - 4. Lemco, Inc.
 - 5. Marsh Industries Inc.
 - 6. AJW Architectural Products

2.2 COMPONENTS

- A. Sheet Steel: Enameling grade steel especially processed for temperatures used in coating porcelain on steel or aluminized-steel face sheet "Vitricite" by Claridge.
- B. Cork: Fine grain natural cork, homogeneous composition.
- C. Tackboard Covering: FS CCC-W-408; Type II - medium; Class 2 - mildew resistant; color as selected; clear top overcoat of polyvinyl fluoride in accordance with FS L-P-1040 Type 1, Grade B, Class 2, 0.0005 inch (0.01 mm) thick.
- D. Hardboard: ANSI A135.4, tempered, smooth face.
- E. Particle Board: ANSI A208.1, wood chips, shavings, flakes, set with waterproof resin binder, sanded faces.

MARKERBOARDS

- F. Foil Backing: Aluminum foil sheet, 0.005 inch thick.
- G. Frame and Markerail: Aluminum extrusions, ASTM B221, 6061 alloy, T5 temper.

2.3 ACCESSORIES

- A. Adhesives: Type used by manufacturer, moisture resistant, thermoplastic-type.
- B. Map Supports: Formed aluminum sliding hooks and roller brackets, to fit map rail.
- C. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.
- D. Flag Holders: Provide one for each room.
- E. Cleaning Instruction Plate: Provide instructions for markerboards cleaning on metal plate fastened to perimeter frame near marker-rail.

2.4 FABRICATION – MARKERBOARDS

- A. Outer Face Sheet: Steel, 24 gage thick or aluminized-steel “LCS” for markerboards by Claridge.
- B. Core: Particle board, 3/8 inch thick.
- C. Backing Surface: Steel, 28 gage thick.
- D. Splice Joint: Concealed spline of sheet steel.

2.5 FABRICATION - TACKBOARDS

- A. Outer Facing: Fabric facing over cork, 1/4 inch thick.
- B. Backing: 1/4 inch thick hardboard.

2.6 FABRICATION – FRAME AND TRIM

- A. Aluminum Frame: Of standard profile; concealed fasteners, map rail with cork insert over markerboard, and tackboard surfaces.
- B. Aluminum Marker-rail: Of standard profile, one piece full length of chalkboard, closed ends; concealed fasteners.

2.7 TACK STRIPS

- A. Provide aluminum framed tack strips with 1 inch cork inserts.

2.8 FACTORY FINISHING

- A. Porcelain Enamel: Glass fibered enamel, baked to vitreous surfaces; Porcelain Enamel Institute Type A; color as selected.
- B. Tackboard Surface: Vinyl, color as selected.

- C. Aluminum Frame, Chalk rail, and Accessories: Clear anodized finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify internal wall blocking is ready to receive Work and positioning dimensions are as indicated on shop drawings and instructed by manufacturer.
- C. Verify flat wall surface for frameless adhesive applied type.

3.2 INSTALLATION

- A. Install markerboards and tackboards in accordance with the manufacturer's instructions.
- B. Secure units level and plumb.
- C. Markerboards: Butt panels tight with concealed spline to hairline joint.
- D. Carefully cut holes in markerboards, and tackboards for thermostats, wall switches, receptacles, etc.

3.3 CLEANING

- A. Division 01 - Execution Requirements: Final cleaning.
- B. Cover chalkboard surfaces with protective cover, taped to frame.
- C. Remove temporary protective cover at date of Substantial Completion.

END OF SECTION 10 1100

SECTION 10 2813 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Toilet accessories.
- B. Attachment hardware.

1.2 REFERENCES

- A. ANSI A117.1 - Safety Standards for the Handicapped.
- B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- E. ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.

1.3 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

REGULATORY REQUIREMENTS

- A. Conform to ANSI A117.1 code and the Americans with Disabilities Act (ADA) for access for the handicapped.

1.5 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated.

1.6 COORDINATION

- A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Bobrick Washroom Equipment, Inc.
- B. Or Architect Approved Equal Products.

2.2 MATERIALS

- A. Sheet Steel: ASTM A366.
- B. Stainless Steel Sheet: ASTM A167, Type 304.
- C. Tubing: ASTM A269, stainless steel.
- D. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FABRICATION

- A. Weld and grind joints of fabricated components, smooth.
- B. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.
- C. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges. Form bar with 1-1/2 inches (75 mm) clear of wall surface. Knurl grip surfaces.
- D. Shop assemble components and package complete with anchors and fittings.
- E. Provide steel anchor plates, adapters, and anchor components for installation.

2.4 KEYING

- A. Supply 2 keys for each accessory to Owner.
- B. Master key all accessories.

2.5 FINISHES

- A. Chrome/Nickel Plating: ASTM B456, Type SC 2 satin finish.
- B. Stainless Steel: No. 4 satin luster finish.
- C. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that site conditions are ready to receive work and dimensions are as

TOILET ACCESSORIES

indicated on shop drawings.

- B. Verify exact location of accessories for installation.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions and ANSI A117.1.
- B. Install plumb and level, securely and rigidly anchored to substrate.

3.4 SCHEDULE (based on Bobrick)

- | | |
|-----------------------------|-----------------------|
| A. Grab Bars: | B-6806 series. |
| B. Mirrors: | B-1658 series. |
| C. Toilet Paper Dispensers: | B-4288 Contura Series |
| D. Paper Towel Dispensers: | B-262 series. |
| E. Soap Dispensers | 818615 Contura Series |
| F. Shower Curtains: | 204-1 with 204-2 |
| G. Robe Hooks: | B-6727 |
| H. Shower Seats: | B-5191. |

END OF SECTION

SECTION 10 4400 - SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes specialty signs.
- B. Forms of specialty signs required include the following:
 - 1. Room signs.

1.2 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Before preparation of shop drawings and schedules, the signage supplier shall meet with the Owner to review signage requirements. The signage supplier shall then prepare a complete sign schedule indicating sign styles, layout and content of each sign, lettering font, foreground and background colors, locations, overall dimensions of each sign.
- C. Samples: Submit two signs, full size illustrating type, style, letter font, and colors specified; method of attachment.
- D. Manufacturer's Installation Instructions: Submit installation template and attachment devices.

1.3 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Package signs, labeled in name groups.
- C. Store adhesive attachment tape at ambient room temperatures.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 - Product Requirements: Environmental conditions affecting products on site.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers of Signs:

1. Green Signs.
2. Ace.
3. APCO Graphics.
4. ACS Sign Systems.
5. ASI Sign Systems.
6. Essential Architectural Signs, Inc.
7. Sign Solutions.
8. Indianapolis Badge & Nameplate Company.
9. Inpro.

2.2 COMPONENTS

- #### A. Room Signs: Provide one (1) sign at each door as indicated on the Floor Plans and Door Schedule. Corridor doors to receive two (2) signs. The sign supplier shall meet with the Owner to finalize exact text to be provided on signs. Submit to the Architect for review. Signs shall be equal to ASI 390 Molded Plastic Frame with SPE plaque. Provide Men's and Women's Restroom Signs and other pictorial signs. All signs shall have information in braille.

1. Text: two rows plus braille.
2. 1 inch slot for inserts.
3. Colors: Colors as selected by the Architect.
4. Total Thickness: **1/8 inch**.
5. Size: Match existing.

PART 3 EXECUTION

3.1 EXAMINATION

- #### A. Verification of existing conditions before starting Work.

3.2 INSTALLATION

- #### A. Install signs after surfaces are finished, in locations scheduled.
- #### B. Install signs level, plumb and at heights required by applicable code.
- #### C. Wall Mounted Signs: Use manufacturer's standard brackets, fittings and hardware as appropriate for mounting signs.

3.3 CLEANING AND PROTECTION

- #### A. At completion of installation, clean soiled sign surface in accordance with manufacturer's instructions. Protect units from damage until acceptance by Owner.

SIGNAGE

END OF SECTION 10 4400

SECTION 12 3216 - PLASTIC LAMINATE CASEWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Cabinets and countertops.
- B. Casework hardware.

1.2 REFERENCES

- A. Countertop Standard: ANSI A161.2
- B. Catalog Standards: Manufacturer's catalog numbers may be shown on drawings or in equipment schedule for convenience in identifying certain cabinet work. Unless modified by notation on drawings or otherwise specified, catalog description for indicated number constitutes requirements for each such cabinet.

1.3 SUBMITTALS

- A. Submit under the provisions of Division 01.
- B. Shop Drawings: Indicate casework locations, large scale plans, elevations, rough-in and anchor placement dimensions and tolerances, clearances required.
- C. Product Data: Provide component dimensions, configurations, construction details and joint details.
- D. Samples: Submit two samples, minimum size 3 x 6 inches (75 x 150 mm) of each color of finish.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ANSI 161.1.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Stevens Cabinet Company, Inc. Product Architectural Designer Series.
- B. L.S.I. Corp. of America, Inc.
- C. Trimline Product.
- D. Case Systems.
- E. Advanced Cabinet Systems
- F. Custom fabricated per enclosed specifications.

2.2 BASIC MATERIALS

- A. Particleboard: ANSI A208.1 mat-formed particleboard, Grade 1-M-2 with minimum density of 40 lbs. per cu. ft., internal bond of 60 psi; and minimum screw holding capacity of 225 lbs. on faces and 200 lbs. on edges.
- B. Plastic Laminate: NEMA LD-3, of thickness, type and grade designation indicated; in colors or patterns and finishes indicated or, if not indicated, as selected by Architect from manufacturer's standard range.
- C. Exposed Surfacing Material of Doors, Drawer Fronts, Fixed Panels, Toeboards and Ends: High pressure decorative laminate, 0.028" thick, General Purpose Type (GP-28).
- D. Semi-Exposed Surfacing Material and Doors: High pressure plastic laminate, 0.020" thick, Cabinet Liner Type (CL-20), in color or pattern and finish matching interior of cabinets, unless otherwise indicated.
- E. Remaining Semi-Exposed Materials: Decorative boards, General Purpose Type, conforming to NEMA LQ-1 with decorative faces in patterns or colors and finish indicated or, if not indicated, as selected by Architect from manufacturer's standard range.
- F. Concealed Materials: Any sound, dry solid lumber, plywood or particleboard or combination thereof; without defects affecting strength, utility or stability. On concealed surfaces of portions constructed of decorative boards, provide decorative or cabinet liner laminate backing (Light-Duty Type).
- G. Core Material for Plastic Laminates: Industrial Grade Particleboard conforming to ANSI A20B.1, Grade 1-M-2.
- H. Treatment of Exposed and Semi-Exposed Edges: Edges of doors and drawer fronts shall have 3mm PVC of a coordinating color.
- I. Cabinet Construction
 - 1. Sides, dividers, tops, bottoms, shelves and stretchers: Not less than 1/2" thick. Provide stretchers at top of base cabinet.
 - 2. Backs: Not less than 3/8" thick for unexposed backs. Exposed backs are to

be 3/4" thick panels of balanced construction tenoned into cabinet ends.

3. Drawers
 - a. Sides, subfronts and backs: not less than 1/2" thick.
 - b. bottoms: not less than 1/4" thick particleboard or provide solid wood sides and back.
 - c. Provide box type construction with front, bottom and back rabbeted in sides.
 - d. All joints secured with glue and mechanical fasteners.
 - e. All drawers must be suspended on extension drawer slides.
4. Joinery
 - a. Rabbet backs flush into end panels and secure with concealed mechanical fasteners.
 - b. Connect wall cabinet tops and bottoms and base cabinet bottoms and stretchers to ends and dividers by means of mechanical fasteners.
 - c. Rabbet tops, bottoms and backs into end panels or cabinetry corner joints to incorporate fluted dowel pin construction.
5. Subbase: Not less than 3/4" thick, of height and relationship to cabinet fronts and exposed ends as indicated. Rubber base furnished and applied continuously per Section 09 6500.
6. Toe Board: Not less than 3/4" thick, attached to subbase with concealed fasteners.

2.3 COUNTERTOPS

- A. Plastic Laminate Material.
- B. Countertop Configuration: Provide self-edge countertops with continuous 4" backsplash.
- C. Countertop Thickness: As indicated or, if not indicated, not less than 1" thick at edges.

2.4 CABINET AND CASEWORK HARDWARE AND ACCESSORIES

- A. General: Provide manufacturer's standard hardware and accessory units of type, size and finish indicated, complying with ANSI A156.9 or, if not indicated, as selected by Architect from manufacturer's standard range.
- B. Hinge: Institutional type, 5 knuckle with 270 degree swing. Provide one pair for doors less than 4 ft. high and 1-1/2 pair for doors over 4 ft.
- C. Pulls: Selected from manufacturer's standard. Provide 2 pulls for drawers over 24" wide.
- D. Door Catches: Nylon roller spring catch or dual self-aligning permanent magnet type. Provide 2 catches on doors over 4 ft. high.

- E. Drawer Slides: Steel slides with ballbearing nylon rollers. 100# rating. File drawers shall have full extension drawer slides for full access to drawer.
- F. Drawer and Cupboard Locks: Provide locks for all casework doors and drawers. Half-mortise type, 5-disc tumbler and dead bolt, round cylinder only exposed, die cast with plated finish.
 - 1. Key each cabinet in room alike.
 - 2. Key each room differently.
 - 3. Provide one master key.
 - 4. Provide two keys each.
- G. Shelf Support Clips: One-piece molded nylon.
- H. Sinks and Faucets: As specified in Division 22.
- I. Finish: Unless otherwise indicated, provide hardware units with manufacturer's standard, satin finish.

2.5 FABRICATION

- A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- B. Fabricate corners and joints without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
- C. Fabricate each unit rigid, not dependent on building structure adjacent units for rigidity.
- D. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
- E. Form edges smooth. Form material for counter tops, facing, shelves, and linings from continuous sheets.
- F. Provide cutouts for plumbing fixtures, appliances, fixtures and fittings. Prime paint contact surfaces of cut edges.
- G. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.6 FINISHES

- A. Exposed To View Surfaces: Plastic Laminate of color and pattern as selected.
- B. Interior Surfaces Not Exposed to View: Standard white melamine.

PART 3 - EXECUTION

3.1 EXAMINATION

PLASTIC LAMINATE CASEWORK

- A. Verify existing conditions.
- B. Verify adequacy of support framing.

3.2 INSTALLATION

- A. Install casework, components and accessories in accordance with manufacturer's instructions.
- B. Use anchoring devices to suit conditions and substrate materials encountered.
- C. Set casework items plumb and square, securely anchored to building structure.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (1 mm). Use filler strips not additional overlay trim for this purpose.
- E. Close ends of units, back splashes, shelves and bases.
- F. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

3.3 ADJUSTING

- A. Adjust work under provisions of Division 01.
- B. Adjust doors, drawers, hardware, fixtures, and other moving or operating parts to function smoothly.

3.4 CLEANING

- A. Clean work under provisions of Division 01.
- B. Clean casework, counters, shelves and hardware.

3.5 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Division 01.
- B. Do not permit finished casework to be exposed to continued construction activity.

3.6 SCHEDULES

- A. See Plans and Details.

END OF SECTION 12 3216

**SECTION 22 05 11
COMMON WORK RESULTS FOR PLUMBING**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section shall apply to all sections of Division 22.
- B. Definitions:
 - 1. Exposed: Piping and equipment exposed to view in finished rooms.
 - 2. Option or optional: Contractor's choice of an alternate material or method.

1.2 QUALITY ASSURANCE

- A. Products Criteria:
 - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years.
 - 2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
 - 3. The products and execution of work specified in Division 22 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official shall be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code shall apply. Any conflicts shall be brought to the attention of the Owner / Architect (RE)/Contracting Officers Technical Representative (COTR).
 - 4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
 - 5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.

6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
 7. Asbestos products or equipment or materials containing asbestos shall not be used.
- B. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Owner / Architect prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
- C. Execution (Installation, Construction) Quality:
1. All items shall be applied to and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract drawings and specifications shall be referred to the OWNER / ARCHITECT for resolution. Written hard copies or computer files of manufacturer's installation instructions shall be provided to the Owner at least two weeks prior to commencing installation of any item.
- F. Plumbing Systems: IPC and International Plumbing Code.

1.4 SUBMITTALS

- A. Submittals shall be submitted in accordance with SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22, with applicable paragraph identification.
- C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- D. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- E. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly

coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

F. Manufacturer's Literature and Data: Manufacturer's literature shall be submitted under the pertinent section rather than under this section.

1. Equipment and materials identification.
2. Fire stopping materials.
3. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
4. Wall, floor, and ceiling plates.

G. Maintenance Data and Operating Instructions:

1. Listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment shall be provided.
2. The listing shall include belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Damaged equipment shall be replaced with an identical unit as determined and directed by the Owner. Such replacement shall be at no additional cost to the Owner.
3. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.

3. The interior of all tanks shall be cleaned prior to delivery and beneficial use by the Owner. All piping shall be tested in accordance with the specifications and the International Plumbing Code (IPC), latest edition. All filters, strainers, fixture faucets shall be flushed of debris prior to final acceptance.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below shall form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
Boiler and Pressure Vessel Code (BPVC):
SEC IX-2007.....Boiler and Pressure Vessel Code; Section IX,
Welding and Brazing Qualifications.
- C. American Society for Testing and Materials (ASTM):
A36/A36M-2008.....Standard Specification for Carbon Structural
Steel
A575-96 (R 2007).....Standard Specification for Steel Bars, Carbon,
Merchant Quality, M-Grades R (2002)
E84-2005.....Standard Test Method for Surface Burning
Characteristics of Building Materials
E119-2008a.....Standard Test Methods for Fire Tests of
Building Construction and Materials
- D. Manufacturers Standardization Society (MSS) of the Valve and Fittings
Industry, Inc:
SP-58-02.....Pipe Hangers and Supports-Materials, Design and
Manufacture
SP 69-2003 (R 2004).....Pipe Hangers and Supports-Selection and
Application
- E. National Electrical Manufacturers Association (NEMA):
MG1-2003, Rev. 1-2007...Motors and Generators
- A. International Code Council, (ICC):
IBC-06, (R 2007).....International Building Code
IPC-06, (R 2007).....International Plumbing Code

PART 2 - PRODUCTS**2.1 FACTORY-ASSEMBLED PRODUCTS**

- A. STANDARDIZATION OF COMPONENTS SHALL BE MAXIMIZED TO REDUCE SPARE PART requirements.
- B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
 - 1. All components of an assembled unit need not be products of same manufacturer.
 - 2. Constituent parts that are alike shall be products of a single manufacturer.
 - 3. Components shall be compatible with each other and with the total assembly for intended service.
 - 4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.
- C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment, which serve the same function, shall be the same make and model

2.2 COMPATIBILITY OF RELATED EQUIPMENT

- A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.3 SAFETY GUARDS

- A. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 6 mm (1/4-inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.
- B. All Equipment shall have moving parts protected from personal injury.

2.4 LIFTING ATTACHMENTS

Equipment shall be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered,

without bending or distortion of shape, such as rapid lowering and braking of load.

2.5 EQUIPMENT AND MATERIALS IDENTIFICATION

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings, or shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING shall be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, fans, etc. shall be identified.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.
- D. Control Items: All temperature, pressure, and controllers shall be labeled and the component's function identified. Identify and label each item as they appear on the control diagrams.
- E. Valve Tags and Lists:
 - 1. Plumbing: All valves shall be provided with valve tags and listed on a valve list (Fixture stops not included).
 - 2. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm (1/4-inch) for service designation on 19 gage, 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
 - 3. Valve lists: Valve lists shall be created using a word processing program and printed on plastic coated cards. The plastic coated valve list card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) shall show valve tag number, valve function and area of control for each service or system. The valve list shall be in a punched 3-ring binder notebook. A copy of the valve list shall be mounted in picture frames for mounting to a wall.
 - 4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided. Each valve location shall be identified with a color coded sticker or thumb tack in ceiling.

2.6 FIRE STOPPING

- A. FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping.

2.9 GALVANIZED REPAIR COMPOUND

- A. Mil. Spec. DOD-P-21035B, paint.

2.10 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

- A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC), latest edition. The Support system of suspended equipment over 227 kg (500 pounds) shall be submitted for approval of the Owner / Architect in all cases. See these specifications for lateral force design requirements.
- B. Type Numbers Specified: MSS SP-58. For selection and application refer to MSS SP-69.
- C. For Attachment to Concrete Construction:
1. Concrete insert: Type 18, MSS SP-58.
 2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (4 inches) thick when approved by the Owner / Architect for each job condition.
 3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (4 inches) thick when approved by the Owner / Architect for each job condition.
- D. For Attachment to Steel Construction: MSS SP-58.
1. Welded attachment: Type 22.
 2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8-inch) outside diameter.
- E. For Attachment to Wood Construction: Wood screws or lag bolts.
- F. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.
- G. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Trapeze hangers are not permitted for steam supply and condensate piping.
1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).

2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13 mm (1/2-inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.

H. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.

1. General Types (MSS SP-58):

- a. Standard clevis hanger: Type 1; provide locknut.
- b. Riser clamps: Type 8.
- c. Wall brackets: Types 31, 32 or 33.
- d. Roller supports: Type 41, 43, 44 and 46.
- e. Saddle support: Type 36, 37 or 38.
- f. Turnbuckle: Types 13 or 15.
- g. U-bolt clamp: Type 24.

h. Copper Tube:

- 1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with isolation tape to prevent electrolysis.
- 2) For vertical runs use epoxy painted or plastic coated riser clamps.
- 3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
- 4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
- i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.
- j. Spring hangers are required on all plumbing system pumps one horsepower and greater.

2. Plumbing Piping (Other Than General Types):

- a. Horizontal piping: Type 1, 5, 7, 9, and 10.

- b. Chrome plated piping: Chrome plated supports.
 - c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
 - d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.
- J. Pre-insulated Calcium Silicate Shields:
- 1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.
 - 2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
 - 3. Shield thickness shall match the pipe insulation.
 - 4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
 - a. Shields for supporting cold water shall have insulation that extends a minimum of one inch past the sheet metal.
 - b. The insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields shall have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.
 - 5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

2.11 PIPE PENETRATIONS

- A. Pipe penetration sleeves shall be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.
- B. Pipe penetration sleeve materials shall comply with all fire stopping requirements for each penetration.
- C. To prevent accidental liquid spills from passing to a lower level, provide the following:
 - 1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
 - 2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.

3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of Owner / Architect.
- D. Sheet metal, plastic, or moisture resistant fiber sleeves shall be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- E. Cast iron or zinc coated pipe sleeves shall be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe shall be made watertight with a modular or link rubber seal. The link seal shall be applied at both ends of the sleeve.
- F. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves shall be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel Sleeve shall be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves shall be connected with a floor plate.
- G. Brass Pipe Sleeves shall be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve shall be connected with a floor plate.
- H. Sleeve clearance through floors, walls, partitions, and beam flanges shall be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

2.12 TOOLS AND LUBRICANTS

- A. Furnish, and turn over to the Owner / Architect, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the Owner / Architect.
- D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in

unopened containers and properly identified as to use for each different application.

2.13 WALL, FLOOR AND CEILING PLATES

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3 inch) pipe, 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates shall be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint shall be provided in spaces where brass or steel pipe sleeves are specified.

2.14 ASBESTOS

Materials containing asbestos are not permitted.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

- A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment shall be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review.

Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.

- B. Operating Personnel Access and Observation Provisions: All equipment and systems shall be arranged to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown on the drawings shall not be changed nor reduced.

- C. Structural systems necessary for pipe and equipment support shall be coordinated to permit proper installation.
- D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.
- E. Cutting Holes:
 - 1. Holes through concrete and masonry shall be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by OWNER / ARCHITECT where working area space is limited.
 - 2. Holes shall be located to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by OWNER / ARCHITECT. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to OWNER / ARCHITECT for approval.
 - 3. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.
- F. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.
- G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
- H. Protection and Cleaning:
 - 1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Owner / Architect. Damaged or defective items in the opinion of the Owner / Architect, shall be replaced.
 - 2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures shall be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

- I. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE. shall be used for all pad or floor mounted equipment. Gages, thermometers, valves and other devices shall be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gages shall be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- J. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.
- K. Work in Existing Building:
 - 1. Make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.
- L. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons shall be sealed with plumbers putty.
- M. Inaccessible Equipment:
 - 1. Where the Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Owner.
 - 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

- A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation shall be provided to maintain continuity of operation of existing facilities.
- B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury

can occur to personnel by contact with operating facilities. The requirements of Para. 3.1 shall apply.

- C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Necessary blind flanges and caps shall be provided to seal open piping remaining in service.

3.3 RIGGING

- A. Openings in building structures shall be planned to accommodate design scheme.
- B. Alternative methods of equipment delivery may be offered and will be considered by Owner under specified restrictions of phasing and service requirements as well as structural integrity of the building.
- C. All openings in the building shall be closed when not required for rigging operations to maintain proper environment in the facility for Owner operation and maintenance of service.
- D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.
- E. Contractor shall check all clearances, weight limitations and shall provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.
- F. Rigging plan and methods shall be referred to OWNER / ARCHITECT for evaluation prior to actual work.

3.4 PIPE AND EQUIPMENT SUPPORTS

- A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes shall be drilled or burned in structural steel ONLY with the prior written approval of the Owner / Architect.
- B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above shall not be permitted. Rusty products shall be replaced.
- C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work shall be provided.

- D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC), latest edition, and these specifications.
- E. Overhead Supports:
1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
 2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
 3. Tubing and capillary systems shall be supported in channel troughs.
- F. Floor Supports:
1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
 2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
 3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignment.
 4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.5 LUBRICATION

- A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. All devices and equipment shall be field checked for proper lubrication.
- B. All devices and equipment shall be equipped with required lubrication fittings. A minimum of one liter (one quart) of oil and 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each different application shall be provided. All materials shall be delivered to OWNER / ARCHITECT in unopened containers that are properly identified as to application.

- C. A separate grease gun with attachments for applicable fittings shall be provided for each type of grease applied.
- D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.
- E. All lubrication points shall be extended to one side of the equipment.

3.6 PLUMBING SYSTEMS DEMOLITION

- A. Rigging access, other than indicated on the drawings, shall be provided after approval for structural integrity by the OWNER / ARCHITECT. Such access shall be provided without additional cost or time to the Owner. Where work is in an operating plant, approved protection from dust and debris shall be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.
- B. In an operating plant, cleanliness and safety shall be maintained. The plant shall be kept in an operating condition. Owner personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work shall be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris shall not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting shall be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. All work shall be performed in accordance with recognized fire protection standards. Inspections will be made by personnel of the VA Medical Center, and the Contractor shall follow all directives of the RE or COTR with regard to rigging, safety, fire safety, and maintenance of operations.
- C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Owner property. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

- D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Owner property and shall be removed and delivered to OWNER / ARCHITECT and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Owner property expeditiously and shall not be allowed to accumulate.

3.7 CLEANING AND PAINTING

- A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Owner, the plant facilities, equipment and systems shall be thoroughly cleaned and painted.
- B. In addition, the following special conditions apply:
1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions shall be repaired prior to applying prime and finish coats.
 2. The following Material And Equipment shall NOT be painted::
 - a. Motors, controllers, control switches, and safety switches.
 - b. Control and interlock devices.
 - c. Regulators.
 - d. Pressure reducing valves.
 - e. Control valves and thermostatic elements.
 - f. Lubrication devices and grease fittings.
 - g. Copper, brass, aluminum, stainless steel and bronze surfaces.
 - h. Valve stems and rotating shafts.
 - i. Pressure gages and thermometers.
 - j. Glass.
 - k. Name plates.
 3. Control and instrument panels shall be cleaned and damaged surfaces repaired. Touch-up painting shall be made with matching paint obtained from manufacturer or computer matched.
 4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer
 5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.

6. The final result shall be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment shall be repainted, if necessary, to achieve this.

3.8 IDENTIFICATION SIGNS

- A. Laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, shall be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.
- B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance shall be placed on factory built equipment.

3.9 STARTUP AND TEMPORARY OPERATION

- A. Start up of equipment shall be performed as described in the equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation.

3.10 OPERATION AND MAINTENANCE MANUALS

- A. Provide four bound copies. The Operations and maintenance manuals shall be delivered to OWNER / ARCHITECT not less than 30 days prior to completion of a phase or final inspection.
- B. All new and temporary equipment and all elements of each assembly shall be included.
- C. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.
- D. Manufacturer's installation, maintenance, repair, and operation instructions for each device shall be included. Assembly drawings and parts lists shall also be included. A summary of operating precautions and reasons for precautions shall be included in the Operations and Maintenance Manual.
- E. Lubrication instructions, type and quantity of lubricant shall be included.
- F. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.
- G. Set points of all interlock devices shall be listed.

- H. Trouble-shooting guide for the control system troubleshooting guide shall be inserted into the Operations and Maintenance Manual.
- I. The combustion control system sequence of operation corrected with submittal review comments shall be inserted into the Operations and Maintenance Manual.
- J. Emergency procedures.

- - - E N D - - -

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Copper tube and fittings.
2. Ductile-iron pipe and fittings.
3. Galvanized steel pipe and fittings.
4. CPVC piping.
5. PEX tube and fittings.
6. Piping joining materials.
7. Encasement for piping.
8. Transition fittings.
9. Dielectric fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 1. Notify Owner no fewer than five days in advance of proposed interruption of water service.
 2. Do not interrupt water service without Owner's written permission.

PART 2 - RODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."
- C. Comply with NSF 372 for low lead.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: [**ASTM B 88, Type L (ASTM B 88M, Type B)**] [**and**] [**ASTM B 88, Type M (ASTM B 88M, Type C)**] water tube, drawn temper.
- B. Soft Copper Tube: [**ASTM B 88, Type K (ASTM B 88M, Type A)**] [**and**] [**ASTM B 88, Type L (ASTM B 88M, Type B)**] water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Elkhart Products Corporation, or comparable products by one of the following:
 - a. NIBCO INC.
 - b. Lee Brass.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Elkhart Products Corporation, made in USA, or comparable products by one of the following:
 - a. NIBCO INC.
- E. Bronze Flanges: MSS SP106, [**Class 125**][**Class 150**], with solder-joint ends.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Elkhart Products Corporation, or comparable products by one of the following:
 - a. NIBCO INC.
 - b. Lee Brass.
- F. Copper Unions:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Elkhart Products Corporation, made in USA, or comparable products by one of the following:

- a. NIBCO INC.
 2. MSS SP-123.
 3. Cast-copper-alloy, hexagonal-stock body.
 4. Ball-and-socket, metal-to-metal seating surfaces.
 5. Solder-joint or threaded ends.
- G. Copper Pressure-Seal-Joint Fittings:
1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Elkhart Products Corporation, made in USA, or comparable products by one of the following:
 - a. NIBCO INC.
 2. For Types K, L, and M hard copper tubing **NPS 1/2 (DN 15)** to **NPS 4 (DN 100)** and soft copper tubing in **NPS 1/2 (DN 15)** to **NPS 1-1/4 (DN 32)**.
 3. Housing: Copper or bronze.
 4. Sealing Element: EPDM.
 5. Multiple leak path detection system.
 6. IAPMO PS-117.
 7. Tools: Manufacturer's special tools.
 8. Maximum **200 psig (1379 kPa)** working-pressure.
 9. Maximum temperature rating at **250 deg F (121 deg C)**.
 10. Maximum test pressures at **600 psig (4136 kPa)**.
 11. Fittings for **NPS 2 (DN 50)** and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
 12. Fittings for **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**: Cast-bronze or wrought-copper with stainless-steel grip ring and EPDM-rubber, O-ring seal in each end.
- H. Copper Push-on-Joint Fittings:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Elkhart Products Corporation; Copper Loc non-removable pressure fittings, made in USA, or comparable products by one of the following:
 - a. Victaulic Company.
 2. Description:
 - a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
 - b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.
- I. Copper-Tube, Extruded-Tee Connections:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. T-DRILL Industries Inc.

2. Description: Tee formed in copper tube according to ASTM F 2104.

J. Wrought-Copper Fittings for Grooved-End Copper Tubing: ASME B16.22.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo-Shurjoint Piping Products USA Inc.; **Wrought copper fittings C10W, C11W, C20W, C21W, C26W, C50W, C52W:**
 - a. Anvil International.
 - b. Grinnell Mechanical Products.
 - c. Victaulic Company.
2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75/B 75M copper tube or ASTM B 584 bronze casting.

K. Mechanical Couplings for Grooved-End Copper Tubing:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo-Shurjoint Piping Products USA Inc.; C305, C306, C307, C341, or comparable products by one of the following:
 - a. Anvil International.
 - b. Grinnell Mechanical Products.
 - c. Victaulic Company.
2. Copper-tube dimensions and design similar to AWWA C606.
3. Ferrous housing sections.
4. EPDM-rubber gaskets suitable for hot and cold water.
5. Bolts and nuts.
6. Minimum Pressure Rating: **300 psig (2070 kPa).**

2.3 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe:

1. ASTM A 53/A 53M, [**Type E**] <Insert type>, [**Grade B**] <Insert grade>, Standard Weight.
2. Include ends matching joining method.

B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.

C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Malleable-Iron Unions:

1. ASME B16.39, Class 150.
2. Hexagonal-stock body.
3. Ball-and-socket, metal-to-metal, bronze seating surface.
4. Threaded ends.

- E. Flanges: ASME B16.1, Class 125, cast iron.
- F. Appurtenances for Grooved-End, Galvanized-Steel Pipe:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International.
 - b. Grinnell Mechanical Products.
 - c. Victaulic Company.
 - 2. Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A 47/A 47M, malleable-iron casting; ASTM A 106/A 106M, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 3. Fittings for Grooved-End, Galvanized-Steel Pipe:
 - a. Comply with NSF-61 for galvanized fittings.
 - b. AWWA C606 for steel-pipe dimensions.
 - c. Ferrous housing sections.
 - d. EPDM-rubber gaskets suitable for hot and cold water.
 - e. Bolts and nuts.
 - f. Minimum Pressure Rating:
 - 1) **NPS 8 (DN 200) and Smaller: [600 psig (4137 kPa)]**
 - 2) **NPS 10 and NPS 12 (DN 250 to DN 300): [400 psig (2758 kPa)]**
 - 3) **NPS 14 to NPS 24 (DN 350 to DN 600): [250 psig (1725 kPa)].**

2.4 CPVC PIPING

- A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40 and Schedule 80.
 - 1. CPVC Socket Fittings: ASTM F 438 for Schedule 40 and ASTM F 439 for Schedule 80.
 - a. Basis-of-Design Product: Manufacturers: Subject to compliance with requirements, provide products by LASCO Fittings, Inc., or comparable products by one of the following:
 - 1) NIBCO INC.
 - 2) Charlotte Pipe and Foundry Company.
 - 2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.
 - a. Basis-of-Design Product: Manufacturers: Subject to compliance with requirements, provide products by LASCO Fittings, Inc., or comparable products by one of the following:
 - 1) NIBCO INC.
 - 2) Charlotte Pipe and Foundry Company.
- B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.

- C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.5 PEX TUBE AND FITTINGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo Fittings, Inc.; Apollo Pex, or comparable products by one of the following:
 - 1. NIBCO INC.
 - 2. Viega LLC.
- B. Tube Material: PEX silane cross-linked high density polyethylene plastic according to ASTM F 876, ASTM F 877, and CSA B 137.5.
 - 1. Certified to NSF 14 and 61.
 - 2. UV Protection: 6 months.
 - 3. Chlorine resistance rating of 5 per ASTM F 876 when tested to ASTM F 2023.
- C. Brass Fittings: PEX Crimp Fittings manufactured to ASTM F 877 and F 1807.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo Fittings, Inc.; Apollo PEX Brass, or comparable products by one of the following:
 - a. NIBCO INC.
 - b. Viega LLC.
- D. Poly Alloy Fittings: PEX Crimp Fittings manufactured to ASTM F 2159.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo Fittings, Inc.; Apollo PEX Poly, or comparable products by one of the following:
 - a. NIBCO INC.
 - b. Viega LLC.
- E. Fittings: ASSE 1061, push-fit fittings.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo Fittings, Inc.; or comparable products by one of the following:
 - a. SharkBite.
 - b. Zurn Industries, LLC.
- F. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 876; with plastic or corrosion-resistant-metal valve for each outlet.

2.6 PVC PIPE AND FITTINGS

- A. PVC Pipe: ASTM D 1785, **Schedule 40 and Schedule 80**].
- B. PVC Socket Fittings: **ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80**.

1. Basis-of-Design Product: Manufacturers: Subject to compliance with requirements, provide products by LASCO Fittings, Inc., or comparable products by one of the following:

- a. NIBCO INC.
- b. Charlotte Pipe and Foundry Company.

C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

1. Basis-of-Design Product: Manufacturers: Subject to compliance with requirements, provide products by LASCO Fittings, Inc., or comparable products by one of the following:

- a. NIBCO INC.
- b. Charlotte Pipe and Foundry Company.

2.7 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, **1/8 inch (3.2 mm)** thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

G. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.8 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser, Inc.
 - c. Ford Meter Box Company, Inc. (The).
 - d. Jay R. Smith Mfg. Co.
 - e. JCM Industries, Inc.
 - f. Romac Industries, Inc.
 - g. Smith-Blair, Inc.
 - h. Viking Johnson.

D. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Charlotte Pipe and Foundry Company.
 - b. Harvel Plastics, Inc.
 - c. Spears Manufacturing Company.
 - d. Uponor.
2. Description:
 - a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
 - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

E. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Colonial Engineering, Inc.
 - b. NIBCO INC.
 - c. Spears Manufacturing Company.
2. Description:
 - a. CPVC or PVC four-part union.
 - b. Brass or stainless-steel threaded end.
 - c. Solvent-cement-joint or threaded plastic end.
 - d. Rubber O-ring.
 - e. Union nut.

2.9 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Capitol Manufacturing Company.
 - c. Central Plastics Company.
 - d. HART Industrial Unions, LLC.
 - e. Jomar Valve.
 - f. Matco-Norca.
 - g. WATTS.
 - h. Wilkins.
 - i. Zurn Industries, LLC.
2. Standard: ASSE 1079.
3. Pressure Rating: **125 psig (860 kPa) minimum at 180 deg F (82 deg C).**
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Matco-Norca.
 - d. WATTS.
 - e. Wilkins.
 - f. Zurn Industries, LLC.
2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: **125 psig (860 kPa) minimum at 180 deg F (82 deg C).**
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: **150 psig (1035 kPa).**
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.

6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elster Perfection Corporation.
 - b. Grinnell Mechanical Products.
 - c. Matco-Norca.
 - d. Precision Plumbing Products.
 - e. Victaulic Company.
2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: **300 psig (2070 kPa) at 225 deg F (107 deg C).**
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance.
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- I. Install piping to permit valve servicing.

- J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- K. Install piping free of sags and bends.
- L. Install fittings for changes in direction and branch connections.
- M. Install PEX tubing with loop at each change of direction of more than 90 degrees.
- N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- O. Install sleeves for piping penetrations of walls, ceilings, and floors.
- P. Install sleeve seals for piping penetrations of concrete walls and slabs.
- Q. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

- I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- K. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. **Roll** groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D 2855.
- N. Joints for PEX Tubing: Join according to the following standards:
 - 1. F 1807 for metal insert and copper crimp ring fittings.
 - 2. F 2159 for polymer insert copper crimp ring fittings.
 - 3. F 877 for bronze and polymer insert PEX press fittings.
 - 4. ASSE 1061 for push-fit fittings.
- O. Joints for PEX Tubing: Join according to ASSE 1061 for push-fit fittings.
- P. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for **NPS 1-1/2 (DN 40)** and Smaller: Fitting-type coupling.
 - 2. Fittings for **NPS 2 (DN 50)** and Larger: Sleeve-type coupling.

- C. Transition Fittings in Aboveground Domestic Water Piping **NPS 2 (DN 50)** and Smaller: Plastic-to-metal transition **fittings or unions**.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for **NPS 2 (DN 50)** and Smaller: Use dielectric **couplings or nipples**.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. **100 Feet (30 m)** and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than **100 Feet (30 m)**: MSS Type 43, adjustable roller hangers.
 - c. Longer Than **100 Feet (30 m)** if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs **100 Feet (30 m)** or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of **3/8 inch (10 mm)**.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. **NPS 3/4 (DN 20)** and Smaller: **60 inches (1500 mm)** with **3/8-inch (10-mm)** rod.
 - 2. **NPS 1 and NPS 1-1/4 (DN 25 and DN 32)**: **72 inches (1800 mm)** with **3/8-inch (10-mm)** rod.
 - 3. **NPS 1-1/2 and NPS 2 (DN 40 and DN 50)**: **96 inches (2400 mm)** with **3/8-inch (10-mm)** rod.
 - 4. **NPS 2-1/2 (DN 65)**: **108 inches (2700 mm)** with **1/2-inch (13-mm)** rod.
 - 5. **NPS 3 to NPS 5 (DN 80 to DN 125)**: **10 feet (3 m)** with **1/2-inch (13-mm)** rod.
 - 6. **NPS 6 (DN 150)**: **10 feet (3 m)** with **5/8-inch (16-mm)** rod.
 - 7. **NPS 8 (DN 200)**: **10 feet (3 m)** with **3/4-inch (19-mm)** rod.
- F. Install supports for vertical copper tubing every **10 feet (3 m)**.

- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
 5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
 6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
 7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
 8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.
- H. Install supports for vertical steel piping every 15 feet (4.5 m).
- I. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
 5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
 6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
 7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
 8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.
- J. Install supports for vertical stainless-steel piping every 15 feet (4.5 m).
- K. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
 2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 3. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 4. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 5. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 6. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
- L. Install supports for vertical CPVC piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.
- M. Install vinyl-coated hangers for PEX tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1 (DN 25) and Smaller: 32 inches (815 mm) with 3/8-inch (10-mm) rod.
- N. Install hangers for vertical PEX tubing every 48 inches (1200 mm).

- O. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 2 (DN 50) and Smaller: 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 2. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 5. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
- P. Install supports for vertical PVC piping every 48 inches (1200 mm).
- Q. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
 2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 3. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 4. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 5. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 6. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
- R. Install supports for vertical PP piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.
- S. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for **NPS 2-1/2 (DN 65)** and larger.

3.7 IDENTIFICATION

- A. Identify system components.
- B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of **50 psig (345 kPa)** above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

- f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least **50 ppm (50 mg/L)** of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least **200 ppm (200 mg/L)** of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.

3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water piping, **NPS 2 (DN 50) and smaller**, shall be **one of the** following:
 - 1. **soft** copper tube, **NPS 1 (DN 25)** and smaller, **ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and brazed joints.**
 - 2. **PVC, Schedule 40 or Schedule 80; socket fittings; and solvent-cemented joints.**
- E. Aboveground domestic water piping, **NPS 2 (DN 50) and smaller**, shall be **one of the** following:
 - 1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - 2. Hard copper tube, **ASTM B 88, Type L (ASTM B 88M, Type B; wrought-copper, solder-joint fittings; and brazed or soldered joints.**
 - 3. Hard copper tube, **NPS 1 (DN 25)** and smaller, **ASTM B 88, Type L (ASTM B 88M, Type B) or ASTM B 88, Type M (ASTM B 88M, Type C); copper push-on-joint fittings; and push-on joints.**
 - 4. CPVC, **Schedule 40; socket fittings; and solvent-cemented joints.**
 - 5. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
 - 6. PEX tube, **NPS 1 (DN 25)** and smaller.
 - a. Fittings for PEX tube:
 - 1) ASTM F 1807, metal insert and copper crimp rings.
 - 2) ASTM F 1960, cold expansion fittings and reinforcing rings.
 - 3) ASSE 1061, push-fit fittings.

3.12 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping **NPS 2 (DN 50)** and smaller. Use butterfly, ball, or gate valves with flanged ends for piping **NPS 2-1/2 (DN 65)** and larger.
 - 2. Throttling Duty: Use ball or globe valves for piping **NPS 2 (DN 50)** and smaller. Use butterfly or ball valves with flanged ends for piping **NPS 2-1/2 (DN 65)** and larger.
 - 3. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

- C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

SECTION 22 13 00
FACILITY SANITARY AND VENT PIPING

PART 1 - GENERAL**1.1 DESCRIPTION**

This section pertains to sanitary sewer and vent systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 SUBMITTALS

- A. Submit the following.
- B. Manufacturer's Literature and Data:
 - 1. Piping.
 - 2. Floor Drains.
 - 3. All items listed in Part 2 - Products.
- C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME): (Copyrighted Society)
 - A112.6.3-01 (R 2007)....Standard for Floor and Trench Drains
 - A13.1-07.....Scheme for Identification of Piping Systems
 - B16.3-06.....Malleable Iron Threaded Fittings, Classes 150 and 300.
 - B16.4-06.....Standard for Grey Iron Threaded Fittings
Classes 125 and 250
 - B16.12-98 (R 2006).....Cast Iron Threaded Drainage Fittings
 - B16.15-06.....Cast Bronze Threaded Fittings, Classes 125 and 250
- C. American Society for Testing and Materials (ASTM):
 - A47/A47M-99 (R 2004)....Standard Specification for Steel Sheet,
Aluminum Coated, by the Hot Dip Process
 - A53/A53M-07.....Standard Specification for Pipe, Steel, Black
And Hot-Dipped, Zinc-coated, Welded and
Seamless
 - A74-06.....Standard Specification for Cast Iron Soil Pipe
and Fittings

- A183-03.....Standard Specification for Carbon Steel Track Bolts and Nuts
- A536-84(R 2004).....Standard Specification for Ductile Iron Castings
- B32-08.....Standard Specification for Solder Metal
- B75-02.....Standard Specification for Seamless Copper Tube
- B306-02.....*Standard Specification for Copper Drainage Tube (DWV)*
- B584-06a.....Standard Specification for Copper Alloy Sand Castings for General Applications
- C564-03a.....Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
- D2000-08.....Standard Classification System for Rubber Products in Automotive Applications
- D2564-04E1.....Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- D2665-08.....*Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings*
- D. International Code Council:
- IPC-06.....International Plumbing Code
- E. Cast Iron Soil Pipe Institute (CISPI):
- 301-05.....Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
- 310-04.....Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
- F. American Society of Sanitary Engineers (ASSE):
- 1018-01.....Trap Seal Primer Valves - Potable, Water Supplied
- G. Plumbing and Drainage Institute (PDI):
- PDI WH-201.....Water Hammer Arrestor

PART 2 - PRODUCTS**2.1 SANITARY WASTE, DRAIN, AND VENT PIPING****A. Cast iron waste, drain, and vent pipe and fittings**

1. Cast iron waste, drain, and vent pipe and fittings shall be used for the following applications:
 - a. pipe buried in or in contact with earth
 - b. sanitary pipe extensions to a distance of approximately 1500 mm (5 feet) outside of the building.
 - c. interior waste and vent piping above grade.
2. Cast iron Pipe shall be bell and spigot or hubless (plain end or no-hub or hubless).
3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI Standard 301, ASTM A-888, or ASTM A-74.
4. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM Standard C-564 or be installed with lead and oakum.

B. Copper Tube, (DWV):

1. Copper DWV tube sanitary waste, drain and vent pipe may be used for piping above ground, except for urinal drains.
2. The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.
3. The copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME 16.29.
4. The joints shall be lead free, using a water flushable flux, and conforming to ASTM B32.

C. Polyvinyl Chloride (PVC)

1. Polyvinyl chloride (PVC) pipe and fittings are permitted where the waste temperature is below 60°C (140°F).
2. PVC piping and fittings shall NOT be used for the following applications:
 - a. Waste collected from steam condensate drains
 - b. spaces such as mechanical equipment rooms, kitchens, SPD, and sterilizer areas.
 - b. Vertical waste and soil stacks serving more than two floors

- c. Exposed in mechanical equipment rooms.
- d. Exposed inside of ceiling return plenums
- 3. Polyvinyl chloride sanitary waste, drain, and vent pipe and fittings shall be schedule 40 solid core sewer piping conforming to ASTM D 1785 and ASTM D2665, sewer and drain series with ends for solvent cemented joints.
- 4. Fittings:
 - a. PVC fittings shall be solvent welded socket type using solvent cement conforming to ASTM D2564.

2.2 EXPOSED WASTE PIPING

- A. Full iron pipe size chrome plated brass piping shall be used in finished rooms for exposed waste piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
 - 1. The Pipe shall meet Fed. Spec. WW-P-351, standard weight.
 - 2. The Fittings shall conform to ANSI B16.15, cast bronze threaded fittings with chrome finish, (125 and 250).
 - 3. Nipples shall conform to ASTM B 687, Chromium-plated.
 - 4. Unions shall be brass or bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.
- B. In unfinished Rooms such as mechanical Rooms and Kitchens, Chrome-plated brass piping is not required. The pipe materials specified under the paragraph "Sanitary Waste, Drain, and Vent Piping" can be used.

2.3 CLEANOUTS

- A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); and not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged sanitary line.
- B. Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The

cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts shall be provided where indicated on drawings and at every building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty type.

- C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) shall be furnished at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed pipe, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.
- D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

2.4 FLOOR DRAINS

- A. Type A (FD-A) floor drain shall comply with ANSI A112.6.3. A caulking flange, inside gasket, or hubless connection shall be provided for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe. The drain connection shall be bottom outlet. A membrane clamp and extensions shall be provided, if required, where installed in connection with waterproof membrane. Puncturing membrane other than for drain opening will not be permitted. Double drainage pattern floor drains shall have integral seepage pan for embedding into floor construction, and weep holes to provide adequate drainage from pan to drain pipe. For drains not installed in connection with a

waterproof membrane, a 2.2 kg (16-ounce) soft copper membrane, 600 mm (24 inches) square or another approved waterproof membrane shall be provided.

2.5 TRAPS

A. Traps shall be provided on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as pipe connected to. Slip joints are not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

2.6 WATERPROOFING

A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproof caulked joint shall be provided at the top hub.

B. Walls: See detail shown on drawings.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

- A. The pipe installation shall comply with the requirements of the Indiana Plumbing Code (IPC) and the International Plumbing Code (IPC) and these specifications.
- B. Branch piping shall be installed for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
- C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.
- D. All pipe runs shall be laid out to avoid interference with other work.
- E. The piping shall be installed above accessible ceilings where possible.
- F. The piping shall be installed to permit valve servicing or operation.

- G. Unless specifically indicated on the drawings, the minimum slope shall be 2% slope.
- H. The piping shall be installed free of sags and bends.
- I. Seismic restraint shall be installed where required by code.
- J. Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Buried soil and waste drainage and vent piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.
- L. Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"
- M. Aboveground copper tubing shall be installed according to CDA's "Copper Tube Handbook".
- N. Aboveground PVC piping shall be installed according to ASTM D2665. Underground PVC piping shall be installed according to ASTM D2321.

3.2 JOINT CONSTRUCTION

- A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- C. Hubless or No-hub, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.

- D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service
 2. Pipe sections with damaged threads shall be replaced with new sections of pipe.
- E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.
- F. For PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendixes.

3.3 PIPE HANGERS, SUPPORTS AND ACCESSORIES:

- A. All piping shall be supported according to the International Plumbing Code (IPC).
- B. Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
- C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.
- D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
1. 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
 2. 80 mm or DN 80 (NPS 3 inch): 1500 mm (60 inches) with 13 mm (1/2 inch) rod.
 3. 100 mm or DN100 to 125 mm or DN125 (NPS 4 to NPS 5): 1500 mm (60 inches) with 16 mm (5/8 inch) rod.
 4. 150 mm or DN150 to 200 mm or DN200 (NPS 6 inch to NPS 8 inch): 1500 mm (60 inches) with 19 mm (3/4 inch) rod.
 5. 250 mm or DN250 to 300 mm or DN 300 (NPS 10 inch to NPS 12 inch): 1500 mm (60 inch) with 22 mm (7/8 inch) rod.
- E. The maximum spacing for plastic pipe shall be 1.22 m (4 feet).

- F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.57 m (15 feet).
- G. Floor, Wall and Ceiling Plates, Supports, Hangers shall have the following characteristics:
1. Solid or split unplated cast iron.
 2. All plates shall be provided with set screws.
 3. Height adjustable clevis type pipe hangers.
 4. Adjustable floor rests and base flanges shall be steel.
 5. Hanger rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
 7. Riser clamps shall be malleable iron or steel.
 8. Rollers shall be cast iron.
- H. Miscellaneous materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.
- I. Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- J. Penetrations:
1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
 2. Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and make watertight with sealant.
- K. Piping shall conform to the following:
1. Waste and Vent Drain to main stacks:

Pipe Size	Minimum Pitch
80 mm or DN 80 (3 inches) and smaller	2%
100 mm or DN 100 (4 inches) and larger	1%

2. Exhaust vents shall be extended separately through roof. Sanitary vents shall not connect to exhaust vents.

3.4 TESTS

- A. Sanitary waste and drain systems shall be tested either in its entirety or in sections.
- B. Waste System tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.
 1. If entire system is tested for a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If the waste system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
 2. For an air test, an air pressure of 35 kPa (5 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the air test.
 3. After installing all fixtures and equipment, open water supply so that all p-traps can be observed. For 15 minutes of operation, all p-traps shall be inspected for leaks and any leaks found shall be corrected.
3. Final Tests: Either one of the following tests may be used.
 - a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.
 - b. Peppermint Test: Introduce (2 ounces) of peppermint into each line or stack.

- - - E N D - - -

**SECTION 23 05 11
COMMON WORK RESULTS FOR H C**

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 23.

B. Definitions:

1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
2. Option or optional: Contractor's choice of an alternate material or method.

1.2 QUALITY ASSURANCE

A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional H C

B. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.
2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
3. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes are more stringent than those specified. Refer any conflicts to the Owner / Architect.

4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
7. Asbestos products or equipment or materials containing asbestos shall not be used.

E. Equipment Service Organizations:

1. H C: Products and systems shall be supported by service organizations that maintain a complete inventory of repair parts and are located within 50 miles to the site.

F. H C Mechanical Systems Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:

1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

G. Execution (Installation, Construction) Quality:

1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the Owner / Architect for resolution. Provide written hard copies or computer files of manufacturer's installation instructions to the Owner / Architect at least two weeks prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations is a cause for rejection of the material.

2. Provide complete layout drawings required by Paragraph, SUBMITTALS.

Do not commence construction work on any system until the layout drawings have been approved.

H. Upon request by Owner, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.

1.3 SUBMITTALS

- A. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- B. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- C. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- D. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient.
- E. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
 - 1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the Owner / Architect.
 - 2. Submit electric motor data and variable speed drive data with the driven equipment.
 - 3. Equipment and materials identification.
 - 4. Fire-stopping materials.
 - 5. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
 - 6. Wall, floor, and ceiling plates.
- F. H C Maintenance Data and Operating Instructions:
 - 1. Maintenance and operating manuals.

2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.
- K. Provide copies of approved H C equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Conditioning, Heating and Refrigeration Institute (AHRI):
430-2009.....Central Station Air-Handling Units
- C. American National Standard Institute (ANSI):
B31.1-2007.....Power Piping
- D. Rubber Manufacturers Association (ANSI/RMA):
IP-20-2007.....Specifications for Drives Using Classical
V-Belts and Sheaves
IP-21-2009.....Specifications for Drives Using Double-V
(Hexagonal) Belts
IP-22-2007.....Specifications for Drives Using Narrow V-Belts
and Sheaves
- E. Air Movement and Control Association (AMCA):
410-96.....Recommended Safety Practices for Air Moving
Devices
- F. American Society of Mechanical Engineers (ASME):
Boiler and Pressure Vessel Code (BPVC):
Section I-2007.....Power Boilers
Section IX-2007.....Welding and Brazing Qualifications
Code for Pressure Piping:
B31.1-2007.....Power Piping
- G. American Society for Testing and Materials (ASTM):
A36/A36M-08.....Standard Specification for Carbon Structural
Steel
A575-96(2007).....Standard Specification for Steel Bars, Carbon,
Merchant Quality, M-Grades
E84-10.....Standard Test Method for Surface Burning
Characteristics of Building Materials

- E119-09c.....Standard Test Methods for Fire Tests of
Building Construction and Materials
- H. Manufacturers Standardization Society (MSS) of the Valve and Fittings
Industry, Inc:
- SP-58-2009.....Pipe Hangers and Supports-Materials, Design and
Manufacture, Selection, Application, and
Installation
- SP 69-2003.....Pipe Hangers and Supports-Selection and
Application
- SP 127-2001.....Bracing for Piping Systems, Seismic - Wind -
Dynamic, Design, Selection, Application
- I. National Electrical Manufacturers Association (NEMA):
- MG-1-2009.....Motors and Generators
- J. National Fire Protection Association (NFPA):
- 31-06.....Standard for Installation of Oil-Burning
Equipment
- 54-09.....National Fuel Gas Code
- 70-08.....National Electrical Code
- 85-07.....Boiler and Combustion Systems Hazards Code
- 90A-09.....Standard for the Installation of Air
Conditioning and Ventilating Systems
- 101-09.....Life Safety Code

1.5 DELIVERY, STORAGE AND HANDLING

- A. Protection of Equipment:
1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
 2. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the Owner / Architect. Such repair or replacement shall be at no additional cost to the Owner.
 3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.

4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use by the Owner.
4. Boilers shall be left clean following final internal inspection by Owner insurance representative or inspector.
5. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.7 JOB CONDITIONS - WORK IN EXISTING BUILDING

- A. Building Operation: Owner employees will be continuously operating and managing all facilities, including temporary facilities, that serve the School.
- B. Maintenance of Service: Schedule all work to permit continuous service as required by the School.
- C. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. No storm water or ground water leakage permitted. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by .
- D. Acceptance of Work for Owner Operation: As new facilities are made available for operation and these facilities are of beneficial use to the Owner, inspections will be made and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Owner personnel.

PART 2 - PRODUCTS**2.1 FACTORY-ASSEMBLED PRODUCTS**

- A. Provide maximum standardization of components to reduce spare part requirements.
- B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
 - 1. All components of an assembled unit need not be products of same manufacturer.
 - 2. Constituent parts that are alike shall be products of a single manufacturer.
 - 3. Components shall be compatible with each other and with the total assembly for intended service.
 - 4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.
- C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3 DRIVE GUARDS

- A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor to prevent damage to equipment and injury to personnel. Drive guards may be excluded where motors and drives are inside factory fabricated air handling unit casings.
- B. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 6 mm (1/4-inch) bolts.

Reinforce guard as necessary to prevent side play forcing guard onto couplings.

- C. V-belt and sheave assemblies shall be totally enclosed, firmly mounted, non-resonant. Guard shall be an assembly of minimum 22-gage sheet steel and expanded or perforated metal to permit observation of belts. 25 mm (one-inch) diameter hole shall be provided at each shaft centerline to permit speed measurement.
- D. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.
- E. Access for Speed Measurement: 25 mm (One inch) diameter hole at each shaft center.

2.4 ELECTRIC MOTORS

- A. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient premium efficiency type motors as scheduled.

2.5 EQUIPMENT AND MATERIALS IDENTIFICATION

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.
- D. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.
- E. Valve Tags and Lists:
 - 1. H C: Provide for all valves.
 - 2. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm (1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.

3. Valve lists: Typed or printed plastic coated card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
4. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

2.6 FIRESTOPPING

FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork.

2.10 GAL NIZED REPAIR COMPOUND

Mil. Spec. DOD-P-21035B, paint form.

2.11 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

- A. Pipe Supports: Comply with MSS SP-58. Type Numbers specified refer to this standard. For selection and application comply with MSS SP-69. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting requirements.
- D. Attachment to Concrete Building Construction:
 1. Concrete insert: MSS SP-58, Type 18.
 2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (four inches) thick when approved by the Owner / Architect for each job condition.
 3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the Owner / Architect for each job condition.
- E. Attachment to Steel Building Construction:
 1. Welded attachment: MSS SP-58, Type 22.
 2. Beam clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23mm (7/8-inch) outside diameter.
- G. Attachment to existing structure: Support from existing floor/roof frame.
- H. Attachment to Wood Construction: Wood screws or lag bolts.
- I. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

J. Hangers Supporting Multiple Pipes (Trapeze Hangers): Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.

1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2-inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

K. Supports for Piping Systems:

1. Select hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 11, H C, PLUMBING, AND BOILER PLANT INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.
2. Piping Systems except High and Medium Pressure Steam (MSS SP-58):
 - a. Standard clevis hanger: Type 1; provide locknut.
 - b. Riser clamps: Type 8.
 - c. Wall brackets: Types 31, 32 or 33.
 - d. Roller supports: Type 41, 43, 44 and 46.
 - e. Saddle support: Type 36, 37 or 38.
 - f. Turnbuckle: Types 13 or 15. Preinsulate.
 - g. U-bolt clamp: Type 24.
 - h. Copper Tube:
 - 1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non adhesive isolation tape to prevent electrolysis.
 - 2) For vertical runs use epoxy painted or plastic coated riser clamps.
 - 3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.

- 4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
- i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.

2.12 PIPE PENETRATIONS

- A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:
 1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
 2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
 3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of Owner / Architect.
- D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.
- G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.
- H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

- I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

2.13 DUCT PENETRATIONS

- A. Provide firestopping for openings through fire and smoke barriers, maintaining minimum required rating of floor, ceiling or wall assembly.

2.14 SPECIAL TOOLS AND LUBRICANTS

- A. Furnish, and turn over to the Owner / Architect, tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Refrigerant Tools: Provide system charging/Evacuation equipment, gauges, fittings, and tools required for maintenance of furnished equipment.
- D. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Owner / Architect.
- E. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.15 WALL, FLOOR AND CEILING PLATES

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

2.16 ASBESTOS

Materials containing asbestos are not permitted.

PART 3 - EXECUTION**3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING**

- A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access of all facilities. Submit the drawings for review as required by Part 1. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.
- C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.
- D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.
- E. Cutting Holes:
 - 1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by Owner / Architect where working area space is limited.
 - 2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by Owner / Architect. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to Owner / Architect for approval.
 - 3. Do not penetrate membrane waterproofing.

- F. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.
- G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
- H. Protection and Cleaning:
1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Owner / Architect. Damaged or defective items in the opinion of the Owner / Architect, shall be replaced.
 2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- J. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum.
- K. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- L. Work in Existing Building:
1. Make alterations to existing service piping at times that will least interfere with normal operation of the facility.
 3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Owner / Architect. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Owner / Architect for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Owner / Architect's approval, carefully cut

opening through construction no larger than absolutely necessary for the required installation.

- N. Work in Animal Research Areas: Seal all pipe and duct penetrations with silicone sealant to prevent entrance of insects.
- O. Switchgear/Electrical Equipment Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Installation of piping, ductwork, leak protection apparatus or other installations foreign to the electrical installation shall be located in the space equal to the width and depth of the equipment and extending from to a height of 1.8 m (6 ft.) above the equipment or to ceiling structure, whichever is lower (NFPA 70).
- P. Inaccessible Equipment:
 - 1. Where the Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Owner.
 - 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

- A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.
- B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Paragraph 3.1 apply.
- C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

3.3 RIGGING

- A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.
- B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Owner under specified restrictions of phasing

and maintenance of service as well as structural integrity of the building.

- C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Owner operation and maintenance of service.
- D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility. Upon request, the Owner will check structure adequacy and advise Contractor of recommended restrictions.
- E. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.
- F. Rigging plan and methods shall be referred to Owner / Architect for evaluation prior to actual work.
- G. Restore building to original condition upon completion of rigging work.

3.4 PIPE AND EQUIPMENT SUPPORTS

- A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the Owner / Architect.
- B. Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.
- C. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work.
- D. H C Horizontal Pipe Support Spacing: Refer to MSS SP-69. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.
- E. H C Vertical Pipe Supports:
 - 1. Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.

2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.

F. Overhead Supports:

1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
3. Tubing and capillary systems shall be supported in channel troughs.

G. Floor Supports:

1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Anchor and dowel concrete bases and structural systems to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
2. Do not locate or install bases and supports until equipment mounted thereon has been approved. Size bases to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Boiler foundations shall have horizontal dimensions that exceed boiler base frame dimensions by at least 150 mm (6 inches) on all sides. Refer to structural drawings. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a granular material to permit alignment and realignment.

3.5 MECHANICAL DEMOLITION

- A. Rigging access, other than indicated on the drawings, shall be provided by the Contractor after approval for structural integrity by the Owner / Architect. Such access shall be provided without additional cost or time to the Owner. Where work is in an operating plant, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.
- B. In an operating facility, maintain the operation, cleanliness and safety. Owner personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation.

Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Do not permit debris to accumulate in the area to the detriment of plant operation. Perform all flame cutting to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards. Inspection will be made by personnel of the School, and Contractor shall follow all directives of the OWNER / ARCHITECT with regard to rigging, safety, fire safety, and maintenance of operations.

- C. Completely remove all piping, wiring, conduit, and other devices associated with the equipment not to be re-used in the new work. This includes all pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. Seal all openings, after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.
- D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Owner property and shall be removed and delivered to Owner / Architect and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Owner property expeditiously and shall not be allowed to accumulate.

3.6 CLEANING AND PAINTING

- A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Owner, the plant facilities, equipment and systems shall be thoroughly cleaned and painted.
- B. In addition, the following special conditions apply:
 - 1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
 - 2. Material And Equipment Not To Be Painted Includes:

- a. Motors, controllers, control switches, and safety switches.
 - b. Control and interlock devices.
 - c. Regulators.
 - d. Pressure reducing valves.
 - e. Control valves and thermostatic elements.
 - f. Lubrication devices and grease fittings.
 - g. Copper, brass, aluminum, stainless steel and bronze surfaces.
 - h. Valve stems and rotating shafts.
 - i. Pressure gauges and thermometers.
 - j. Glass.
 - k. Name plates.
3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
 4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer
 5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
 7. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.7 IDENTIFICATION SIGNS

- A. Provide laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, designating functions, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.
- B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.
- C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.8 MOTOR AND DRIVE ALIGNMENT

- A. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.

- B. Direct-connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

3.9 LUBRICATION

- A. Lubricate all devices requiring lubrication prior to initial operation. Field-check all devices for proper lubrication.
- B. Equip all devices with required lubrication fittings or devices. Provide a minimum of one liter (one quart) of oil and 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each different application; also provide 12 grease sticks for lubricated plug valves. Deliver all materials to Owner / Architect in unopened containers that are properly identified as to application.
- C. Provide a separate grease gun with attachments for applicable fittings for each type of grease applied.
- D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

3.10 STARTUP AND TEMPORARY OPERATION

Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation.

3.12 OPERATING AND PERFORMANCE TESTS

- A. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Owner.
- B. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

- - - E N D - - -

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. VRF / VRF
 - b. Exhaust.

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 SUBMITTALS

- A. Certified TAB reports.

1.4 QUALITY ASSURANCE

- 1. TAB Technician: Employee of the TAB contractor and who is certified by **NEBB or TABB** as a TAB technician.
- B. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by **Architect**

- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- E. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- F. Examine test reports specified in individual system and equipment Sections.
- G. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- H. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- I. Examine operating safety interlocks and controls on HVAC equipment.
- J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.
 - 4. Balance, smoke, and fire dampers are open.
 - 5. Isolating and balancing valves are open and control valves are operational.
 - 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in **inch-pound (IP)** units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.

3.5 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING VRV or VRF SYSTEMS

- A. Perform a preconstruction inspection of equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 3. Check the refrigerant charge.
 - 4. Check the condition of filters.
 - 5. Check the condition of coils.
 - 6. Check the operation of the drain pan and condensate-drain trap.
 - 7. Check bearings and other lubricated parts for proper lubrication.
 - 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of systems, inspect equipment that is to remain and be reused to verify that equipment has been cleaned and refurbished. Verify the following:
 - 1. New filters are installed.
 - 2. Coils are clean and fins combed.
 - 3. Drain pans are clean.
 - 4. Fans are clean.
 - 5. Bearings and other parts are properly lubricated.
 - 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that systems are affected by the renovation work.
 - 1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.

2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.6 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 1. Fan curves.
 2. Manufacturers' test data.
 3. Field test reports prepared by system and equipment installers.
 4. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 1. Title page.
 2. Name and address of the TAB contractor.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.

15. Test conditions for fans and pump performance forms including the following:

- a. Settings for outdoor-, return-, and exhaust-air dampers.
- b. Conditions of filters.
- c. Cooling coil, wet- and dry-bulb conditions.
- d. Fan drive settings including settings and percentage of maximum pitch diameter.
- e. Settings for supply-air, static-pressure controller.
- f. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Terminal units.
5. Balancing stations.
6. Position of balancing devices.

3.7 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

1.2 SUBMITTALS

A. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Fittings.
6. Reinforcement and spacing.
7. Seam and joint construction.
8. Penetrations through fire-rated and other partitions.
9. Equipment installation based on equipment being used on Project.
10. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
11. Hangers and supports, including methods for duct and building attachment and vibration isolation.

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

- #### A. General Fabrication Requirements:
- Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: **G60 (Z180)**.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Aluminum Sheets: Comply with **ASTM B 209 (ASTM B 209M)** Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- G. Tie Rods: Galvanized steel, **1/4-inch (6-mm)** minimum diameter for lengths **36 inches (900 mm)** or less; **3/8-inch (10-mm)** minimum diameter for lengths longer than **36 inches (900 mm)**.

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: **3 inches (76 mm)**
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: **10-inch wg (2500 Pa)**, positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: **Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C)**.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.

5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- D. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of **1 inch (25 mm)**, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least **1-1/2 inches (38 mm)**.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Conditioned Space, Exhaust Ducts: Seal Class B.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.7 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
- B. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative **1-inch wg (250 Pa)**
 - b. Minimum SMACNA Seal Class: **A** if negative pressure, and **A** if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: **12**.
 - d. SMACNA Leakage Class for Round and Flat Oval: **6**.
- C. Intermediate Reinforcement:
 - 1. Galvanized-Steel Ducts: **Galvanized steel**.
 - 2. Aluminum Ducts: **Aluminum**
- D. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Velocity **1000 fpm (5 m/s)** or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity **1000 to 1500 fpm (5 to 7.6 m/s)**:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.

- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 - c. Velocity **1500 fpm (7.6 m/s)** or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity **1000 fpm (5 m/s)** or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity **1000 to 1500 fpm (5 to 7.6 m/s)**: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity **1500 fpm (7.6 m/s)** or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - b. Round Elbows, [**12 Inches (305 mm)**] and Smaller in Diameter: Stamped or pleated.
- E. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

- a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
- b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
- c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 238129 - VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes complete VRF HVAC system(s) including, but not limited to, delegated design and the following components to make a complete operating system(s) according to requirements indicated:
 - 1. Recessed, ceiling-mounted (360 cassette) indoor units.

1.3 DEFINITIONS

- A. Air-Conditioning System Operation: System capable of operation with all zones in cooling only.
- B. EEPROM: Electrically erasable programmable read-only memory.
- C. Electronic Expansion Valve (EEV): EEV's are used in heat pump and heat recovery systems.
- D. Heat Pump (HP) System Operation: System capable of operation with all zones in either heating or cooling, but not with simultaneous heating and cooling zones that transfer heat between zones.
- E. Heat Recovery (HR) System Operation: System capable of operation with simultaneous heating and cooling zones that transfer heat between zones.
- F. HSP: High static pressure.
- G. Mode Control Unit (MCU): MCU's are used in heat recovery VRF HVAC systems to manage and control refrigerant between indoor units to provide simultaneous heating and cooling zones.
- H. MSP: Medium static pressure.
- I. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

- J. OAP: Outside air processing.
- K. PCB: Printed circuit board.
- L. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.
- M. Three-Pipe System Design: One high pressure refrigerant vapor line, one low pressure refrigerant vapor line, and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system MCUs. One liquid line and refrigerant vapor line connect MCUs to associated indoor units.
- N. VRF: Variable refrigerant flow.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for indoor and outdoor units.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 3. Include operating performance at design conditions and at extreme maximum and minimum outdoor ambient conditions.
 - 4. Include description of system controllers, dimensions, features, control interfaces and connections, power requirements, and connections.
 - 5. Include system operating sequence of operation in narrative form for each unique indoor-and outdoor-unit control.
 - 6. Include description of control software features.
 - 7. Include total refrigerant required and a comprehensive breakdown of refrigerant required by each system installed.
 - 8. Include refrigerant type and data sheets showing compliance with requirements indicated.
 - 9. For system design software.
 - 10. Indicate location and type of service access.
- B. Shop Drawings: For VRF HVAC systems.
 - 1. Include plans, elevations, sections, and mounting attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

4. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
5. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittals:

1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.
2. Include design calculations with corresponding diagram of refrigerant piping and tubing sizing for each system installed.
3. Include design calculations with corresponding floor plans indicating that refrigerant concentration limits are within allowable limits of ASHRAE 15 and governing codes.
4. Include calculations showing that system travel distance for refrigerant piping and controls cabling are within horizontal and vertical travel distances set by manufacturer. Provide a comparison table for each system installed.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, sections, and details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural floors, roofs and associated members to which equipment, piping, cables, and conduit will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Wall-mounted controllers located in finished space showing relationship to light switches, fire-alarm devices, and other installed devices.
5. Size and location of access doors and panels installed behind walls and inaccessible ceilings for products installed behind walls and requiring access.
6. Items penetrating finished ceiling including the following:
 - a. Luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Service access panels.

B. Qualification Data:

1. For Installer: Certificate from VRF HVAC system manufacturer certifying that Installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
 - a. Retain copies of Installer certificates on-site and make available on request.

2. For VRF HVAC system manufacturer.
3. For VRF HVAC system provider.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For VRF HVAC systems to include in emergency, operation, and maintenance manuals. Service and installation manuals must be readily available on the manufacturer's website without entering a username and password.
- B. Software and Firmware Operational Documentation:
 1. Software operating and upgrade manuals.
 2. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Filters:
 - a. One set(s) for each unit with replaceable filters.

1.8 QUALITY ASSURANCE

- A. Provide unit that is specified on the drawings, to match existing Mitsubishi system.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.
 1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
 2. Installer certification shall be valid and current for duration of Project.
 3. The installing contractor shall have attended VRF HVAC system manufacturer's installation training prior to installing the system.
 4. Retain copies of Installer certificates on-site and make available on request.
 5. Each person assigned to Project shall have demonstrated past experience.
- C. Deliver and store products in a clean and dry place.

- D. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.
- E. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.
- F. Protect products from weather, dirt, dust, water, construction debris, and physical damage.
 - 1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
 - 2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remove coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.
- G. Replace installed products damaged during construction.

1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide VRF split system heat recovery for simultaneous cooling and heating.:
 - 1. Mitsubishi Electric & Electronics USA, Inc.

2.2 SYSTEM DESCRIPTION

- A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.

2.3 RECESSED, CEILING-MOUNTED (360 CASSETTE) INDOOR UNIT

- A. As indicated on drawings.
- B. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and control board with field connections.

2.4 SYSTEM REFRIGERANT AND OIL

A. Refrigerant:

1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
2. ASHRAE 34, Class A1 refrigerant classification.
3. Refrigerant: A full charge of R-410A is included only for the condensing unit by VRF HVAC system manufacturer. Provide additional refrigerant based on diameters and lengths of system liquid refrigerant lines, and indoor equipment model and quantity.

B. Oil:

1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

2.5 SYSTEM CONDENSATE DRAIN PIPING

A. If more than one material is listed, material selection is Contractor's option.

B. CPVC plastic pipe according to ASTM F 441/F 441M, Schedule 40, with socket-type pipe fittings according to ASTM F 438 and solvent cement according to ASTM F 493, wrapped in insulation meeting plenum fire/smoke protection.

C. PVC plastic pipe according to ASTM D 1785, Schedule 40, with socket-type pipe fittings according to ASTM D 2466 and solvent cement according to ASTM D 2564, primer according to ASTM F 656, wrapped in insulation meeting plenum fire/smoke protection.

2.6 SYSTEM REFRIGERANT PIPING

A. Refrigerant Piping:

1. Copper Tube: ASTM B 280, Type ACR
2. Wrought-Copper Fittings: ASME B16.22.
3. Brazing Filler Metals: AWS A5.8/A5.8M.
4. Insulation: Insulate both heat pump refrigerant lines. Insulate all three refrigerant lines from heat recovery outdoor units to MCU.

B. Refrigerant Tubing Kits:

1. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
2. Modular systems require outdoor refrigerant kits for module connections.
3. Standard one-piece length for connecting to indoor units.

4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.
 5. Factory Charge: Dehydrated air or nitrogen.
- C. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.
1. Y-Joint Fittings: Piping to multiple indoor units requires additional piping components. Use VRF HVAC system manufacturer's Y-joint fittings to branch the main refrigerant lines.
 2. Tee Fittings: VRF HVAC system manufacturer's tee fittings must be used to connect outdoor units when multiple module systems are being installed (systems with more than one outdoor unit).
- D. Refrigerant Isolation Ball Valves:
1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
 2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
 3. Valve Connections: Flare or sweat depending on size.

2.7 METAL HANGERS AND SUPPORTS

A. Copper Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of [**galvanized or copper-coated steel**] [**stainless steel**] <Insert material>.

B. Plastic Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, galvanized-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of [**galvanized steel**] [**stainless steel**] <Insert material>.

2.8 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

VARIABLE
REFRIGERANT
FLOW HVAC
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- a. B-line, an Eaton business.
 - b. Flex-Strut Inc.
 - c. G-Strut.
 - d. Haydon Corporation.
 - e. Thomas & Betts Corporation; A Member of the ABB Group.
 - f. Unistrut; Part of Atkore International.
 - g. Wesanco, Inc.
2. Description: Shop- or field-fabricated, pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel for use indoors and of stainless steel for use outdoors.
7. Metallic Coating for Use Indoors: hot-dip galvanized.

2.9 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded, zinc-coated steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 1. Indoor Applications: Zinc-coated or stainless steel.

2.10 PIPING AND TUBING INSULATION

- A. Condensate Drain Piping and Tubing Insulation and Jacket Requirements:
 1. Flexible Elastomeric Insulation:
 - a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C 534, Type I for tubular materials.
 - b. Indoors: **1/2 inch (13 mm)** thick.
- B. Refrigerant Tubing Insulation and Jacket Requirements:
 1. Flexible Elastomeric Insulation:

- a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C 534, Type I for tubular materials.
 - b. Indoors: **1 inch (25 mm)**.
- C. Flexible Elastomeric Insulation Adhesive: Comply with MIL-A-24179A, Type II, Class I.

2.11 SYSTEM CONTROL CABLE

- A. Cable Rating: Listed and labeled for application according to NFPA 70.
 - 1. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
 - a. Flame Travel Distance: **60 inches (1520 mm)** or less.
 - b. Peak Optical Smoke Density: 0.5 or less.
 - c. Average Optical Smoke Density: 0.15 or less.
 - 2. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
 - 3. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.
- B. Low-Voltage Control Cabling:
 - 1. Paired Cable: NFPA 70, Type CMG.
 - a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
 - b. PVC insulation.
 - c. Braided or foil shielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1685.

2.12 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect factory-assembled equipment.
- B. Equipment will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports for historical record. Submit reports only if requested.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine products before installation. Reject products that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for piping and tubing to verify actual locations of connections before equipment installation.
- D. Examine roughing-in for wiring and conduit to verify actual locations of connections before equipment installation.
- E. Examine walls, floors, roofs, and outdoor pads for suitable conditions where equipment will be installed.
- F. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION, GENERAL

- A. Clearance:
 - 1. Maintain manufacturer's recommended clearances for service and maintenance.
 - 2. Maintain clearances required by governing code.
- B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.

3.3 INSTALLATION OF INDOOR UNITS

- A. Install units to be level and plumb while providing a neat and finished appearance.
- B. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch (10 mm).
- C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.
- D. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.
- E. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.

- F. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.
- G. Provide lateral bracing if needed to limit movement of suspended units to not more than **0.25 inch (13 mm)**.

3.4 GENERAL REQUIREMENTS FOR PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping and tubing to permit valve servicing.
- F. Install piping and tubing at indicated slopes.
- G. Install piping and tubing free of sags.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping and tubing to allow application of insulation.
- J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.
- K. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- L. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.5 INSTALLATION OF SYSTEM CONDENSATE DRAIN PIPING

- A. General Requirements for Drain Piping and Tubing:

1. Install a union in piping at each threaded unit connection.
2. Install an adjustable stainless-steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.
3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:
 - a. Details indicated on Drawings.
 - b. Manufacturer's requirements.
 - c. Governing codes.
 - d. In the absence of requirements, comply with requirements of ASHRAE handbooks.
4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.

B. Gravity Drains:

1. Slope piping from unit connection toward drain termination at a constant slope of not less than one percent.

C. Pumped Drains:

1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

3.6 INSTALLATION OF REFRIGERANT PIPING

A. Refrigerant Tubing Kits:

1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
2. Support tubing using hangers and supports indicated at intervals not to exceed **5 feet (1.5 m)**. Minimum rod size, **1/4 inch (6.4 mm)**.
3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.

B. Install refrigerant piping according to ASHRAE 15 and governing codes.

C. Select system components with pressure rating equal to or greater than system operating pressure.

- D. Install piping as short and direct as possible, with a minimum number of joints and fittings.
- E. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection.
- F. Install refrigerant piping and tubing in protective conduit where installed belowground.
- G. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.
- H. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:
 - 1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- I. When brazing, remove or protect components that could be damaged by heat.
- J. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.
- K. Joint Construction:
 - 1. Ream ends of tubes and remove burrs.
 - 2. Remove scale, slag, dirt, and debris from inside and outside of tube and fittings before assembly.
 - 3. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
 - a. Use Type BCuP (copper-phosphorus) alloy for joining copper fittings with copper tubing.
 - b. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze.

3.7 INSTALLATION OF METAL HANGERS AND SUPPORTS

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- C. Comply with MFMA-103 for metal framing system selections and applications that are not specified.

D. Fastener System Installation:

1. Install powder-actuated fasteners, for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick, in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
3. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. Install building attachments within concrete slabs or attach to structural steel.

1. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Piping and Tubing Insulation:

1. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
2. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.

L. Horizontal-Piping Hangers and Supports: Install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.

3. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 4. Multiple horizontal pipes located indoors may use metal framing systems with split clamp attachment for each pipe in lieu of individual clevis hangers.
 5. Pipe stands for horizontal pipes located outdoors.
 6. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
 7. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- M. Horizontal Piping Hanger Spacing and Rod Size: Install hangers for drawn-temper copper piping with the following maximum horizontal spacing and minimum rod sizes:
1. Sizes through **NPS 3/4 (DN 20)**: Maximum span, **5 feet (1.5 m)**; minimum rod size, **1/4 inch (6.4 mm)**.
- N. Plastic Pipe Hanger and Support Spacing:
1. Space hangers and supports according to pipe manufacturer's written instructions for service conditions.
 2. Maximum spacing, **5 feet (1.5 m)**; minimum rod size, **1/4 inch (6.4 mm)**.
- O. Vertical-Piping Clamps: Install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8).
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): If longer ends are required for riser clamps.
- P. Support vertical runs at roof, at each floor, and at midpoint intervals between floors, not to exceed **5 feet (1.5 m)**.
- Q. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified.
- R. Use hangers, supports, and attachments with galvanized coatings unless otherwise indicated.
- S. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- T. Trim excess length of continuous-thread hanger and support rods to **1 inch (25 mm)**.
- U. Hanger-Rod Attachments: Install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to **6 inches (150 mm)** for heavy loads.
 2. Steel Clevises (MSS Type 14): For **120 to 450 deg F (49 to 232 deg C)** piping installations.

3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

V. Building Attachments: Install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

3.8 INSTALLATION OF PIPING AND TUBING INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Installation to maintain a continuous vapor barrier.
- B. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are unavailable, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Where PVC jackets are indicated, install with **1-inch (25-mm)** overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- E. Where metal jackets are indicated, install with **2-inch (50-mm)** overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands **12 inches (300 mm)** o.c. and at end joints.

3.9 ELECTRICAL INSTALLATION

- A. Comply with requirements indicated on Drawings and in applicable Division 26 Sections.
- B. To extent electrical power is required for system equipment, components, and controls, and is not indicated on Drawings and addressed in the Specifications, the design for such electrical power shall be delegated to VRF HVAC system provider.
1. Delegated design of electrical power to equipment, components and controls, and associated installation shall be included at no additional cost to Owner.
- C. Connect field electrical power source to each separate electrical device requiring field electrical power. Coordinate termination point and connection type with Installer.
- D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.
- E. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding connections.

- F. Install nameplate or acrylic label with self-adhesive back for each electrical connection indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated phenolic layers of black with engraved white letters. Letters at least **1/2 inch (13 mm)** high.
 - 2. Locate nameplate or label where easily visible.
- G. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or revised in this Section.
 - 1. Outlet boxes shall be no smaller than **2 inches (50 mm)** wide, **3 inches (75 mm)** high, and **2-1/2 inches (64 mm)** deep.
 - 2. Flexible metal conduit shall not be used.
- H. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
- I. Install manufactured conduit sweeps and long-radius elbows if possible.
- J. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.10 INSTALLATION OF SYSTEM CONTROL CABLE

- A. Comply with NECA 1.
- B. Installation Method:
 - 1. Install cables in raceways except as follows:
 - a. Within equipment and associated control enclosures.
 - b. In accessible ceiling spaces where open cable installation method may be used.
 - 2. Conceal raceway and cables except in unfinished spaces.
- C. General Requirements for Cabling:
 - 1. Comply with TIA-568-C Series of standards.
 - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
 - 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable.

5. Cables serving a common system may be grouped in a common raceway. Install control cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
 6. Secure and support cables at intervals not exceeding **30 inches (760 mm)** and not more than **6 inches (150 mm)** from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
 9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
 10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
 11. Support: Do not allow cables to lie on removable ceiling tiles or access panels.
 12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
 13. Provide strain relief.
 14. Keep runs short. Allow extra length for connecting to terminals.
 15. Do not bend cables in a radius less than 10 times the cable OD.
 16. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
 17. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.
- D. Balanced Twisted-Pair Cable Installation:
1. Comply with TIA-568-C.2.
 2. Do not untwist balanced twisted-pair cables more than **1/2 inch (13 mm)** at the point of termination to maintain cable geometry.
- E. Open-Cable Installation:
1. Suspend copper cable not in a wireway or pathway a minimum of **8 inches (200 mm)** above ceilings by cable supports not more than **30 inches (760 mm)**.
 2. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.
- F. Separation from EMI Sources: Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded cable from potential EMI sources including electrical power wiring and equipment.

3.11 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.12 GROUNDING INSTALLATION

- A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.
- B. For low-voltage control cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.13 IDENTIFICATION

- A. Identify system equipment, piping, tubing, and valves. Comply with requirements for identification specified in Section 230553 "Identification for HVAC Piping and Equipment."
- B. Identify system electrical **and controls** components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Identify each control cable on each end and at each terminal with a number-coded identification tag. Each cable shall have a unique tag.

3.14 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage VRF HVAC system manufacturer's service representative to advise and assist installers; witness testing; and observe and inspect components, assemblies, and equipment installations, including controls and connections.
 - 1. Field service shall be performed by a factory-trained and -authorized service representative of VRF HVAC system manufacturer whose primary job responsibilities are to provide direct technical support of its products.
 - 2. Manufacturer shall provide on-site visits during the course of construction at installation milestones indicated. System Installer shall coordinate each visit in advance to give manufacturer sufficient notice to plan the visit.
- B. Refrigerant Tubing Positive Pressure Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing installation, pressurize tubing systems to a test pressure of not less than **1.5** times VRF HVAC system operating pressure, but not less than **600 psig (4137 kPa)**, using **dry nitrogen**

C. Refrigerant Tubing Evacuation Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing positive-pressure testing, evacuate tubing systems to a pressure of 500 microns.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of one hour(s) with no change.
4. Upon successful completion of evacuation testing, system shall be charged with refrigerant.

D. System Refrigerant Charge:

1. Using information collected from the refrigerant tubing evacuation testing, system Installer shall consult variable refrigerant system manufacturer to determine the correct system refrigerant charge.
2. Installer shall charge system following VRF HVAC system manufacturer's written instructions.
3. System refrigerant charging shall be witnessed by system manufacturer's representative.
4. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

3.15 STARTUP SERVICE

A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.

1. Service representative shall be a factory-trained and -authorized service representative of VRF HVAC system manufacturer.
2. Complete startup service of each separate system.
3. Complete system startup service according to manufacturer's written instructions.

B. Startup checks shall include, but not be limited to, the following:

1. Check control communications of equipment and each operating component in system(s).
2. Check each indoor unit's response to demand for cooling and heating.
3. Check each indoor unit's response to changes in airflow settings.
4. Check each indoor unit and outdoor unit for proper condensate removal.

- C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.
 - 1. Installer shall correct deficiencies found during startup service for reverification.
- D. System Operation Report:
 - 1. After completion of startup service, manufacturer shall issue a report for each separate system.
 - 2. Report shall include complete documentation describing each startup check, the result, and any corrective action required.
 - 3. Manufacturer shall electronically record not less than two hours of continuous operation of each system and submit with report for historical reference.
 - a. All available system operating parameters shall be included in the information submitted.

3.16 ADJUSTING

- A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.
- C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.

3.17 PROTECTION

- A. Protect products from moisture and water damage. Remove and replace products that are wet, moisture damaged, or mold damaged.
- B. Protect equipment from physical damage. Replace equipment with physical damage that cannot be repaired to new condition. Observable surface imperfections shall be grounds for removal and replacement.
- C. Protect equipment from electrical damage. Replace equipment suffering electrical damage.
- D. Cover and seal openings of equipment to keep inside of equipment clean. Do not remove covers until finish work is complete.

END OF SECTION 238129

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For sleeve seals.

1.5 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 3. To allow right of way for piping and conduit installed at required slope.
 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than **50 inches (1270 mm)** and no side more than **16 inches (400 mm)**, thickness shall be **0.052 inch (1.3 mm)**.
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, **50 inches (1270 mm)** and 1 or more sides equal to, or more than, **16 inches (400 mm)**, thickness shall be **0.138 inch (3.5 mm)**.

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: **[EPDM]** interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: **[Plastic]** **[Carbon steel]** **[Stainless steel]**. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: **[Carbon steel with corrosion-resistant coating]** **[Stainless steel]** of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors [**2 inches (50 mm)**] **<Insert dimension>** above finished floor level.
- G. Size pipe sleeves to provide [**1/4-inch (6.4-mm)**] **<Insert dimension>** annular clear space between sleeve and raceway or cable, unless indicated otherwise.

- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using [steel] [cast-iron] pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: [**Copper**] wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No.[8] AWG and smaller, and stranded conductors for No.[6] AWG and larger, unless otherwise indicated.
- B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.

2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install [**tinned**] bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
- B. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: **[10]** ohms.
 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: **[5]** ohms.
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: **[3]** ohms.
 4. Power Distribution Units or Panelboards Serving Electronic Equipment: **[3]** > ohm(s).
 5. ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of [**five**] times the applied force.

1.3 SUBMITTALS

- A. Product Data: For steel slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 1. Trapeze hangers. Include Product Data for components.
 2. Steel slotted channel systems. Include Product Data for components.
 3. Equipment supports.
- C. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 6. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: [**Steel**] [hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

- b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
- 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
- 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
- 6. Toggle Bolts: All-steel springhead type.
- 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as **[scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in]** NFPA 70. Minimum rod size shall be **1/4 inch (6 mm)** in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted **[or other]** support system, sized so capacity can be increased by at least **[25]** percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with **[two-bolt conduit clamps]** Retain paragraph below for projects where seismic design requirements do not apply. Consider retaining for light-commercial projects only.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for **1-1/2-inch (38-mm)** and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, **[EMT]** may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus **200 lb (90 kg)**.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete **4 inches (100 mm)** thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than **4 inches (100 mm)** thick.

6. To Steel [**Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69**]
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate[**by means that meet seismic-restraint strength and anchorage requirements**].

- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of **2.0 mils (0.05 mm)**.
- B. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. See Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks and manholes, and underground handholes, boxes, and utility construction.

1.2 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.

- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT: **[Steel]** type.

2.3 METAL WIREWAYS

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Square D; Schneider Electric.
- C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type **[1]**, unless otherwise indicated.
- D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- E. Wireway Covers: **[Screw-cover type]**.
- F. Finish: Manufacturer's standard enamel finish.

2.2 NONMETALLIC WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hoffman.
 - 2. Lamson & Sessions; Carlon Electrical Products.
- B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.3 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from colors.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Butler Manufacturing Company; Walker Division.
 - b. Enduro Systems, Inc.; Composite Products Division.
 - c. Hubbell Incorporated; Wiring Device-Kellems Division.
 - d. Lamson & Sessions; Carlon Electrical Products.
 - e. Panduit Corp.
 - f. Walker Systems, Inc.; Wiremold Company (The).
 - g. Wiremold Company (The); Electrical Sales Division.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, [**aluminum**], Type FD, with gasketed cover.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- D. Metal Floor Boxes: [**Sheet metal**] rectangular.
- E. Nonmetallic Floor Boxes: Nonadjustable, round.

- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, [**galvanized, cast iron**] with gasketed cover.
- H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic
- I. Cabinets:
 - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: [**Rigid steel conduit**].
 - 2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): [**LFMC**].
- B. Comply with the following indoor applications, unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: [**EMT**] .
 - 2. Exposed, Not Subject to Severe Physical Damage: [**EMT**]
 - 3. Exposed and Subject to Severe Physical Damage: [**Rigid steel conduit**]
Includes raceways in the following locations:
 - a. Mechanical rooms.
 - 4. Concealed in Ceilings and Interior Walls and Partitions:
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 - 6. Damp or Wet Locations: [**Rigid steel conduit**] .
 - 7. Raceways for Optical Fiber or Communications Cable: [**EMT**] .

8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, **[nonmetallic]** in damp or wet locations.
- C. Minimum Raceway Size: **[1/2-inch (16-mm)] [3/4-inch (21-mm)]** trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least **6 inches (150 mm)** away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
 1. Run conduit larger than **1-inch (27-mm)** trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

- J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than **200-lb (90-kg)** tensile strength. Leave at least **12 inches (300 mm)** of slack at each end of pull wire.
- K. Raceways for Optical Fiber and Communications Cable: Install as follows:
1. **3/4-Inch (19-mm)** Trade Size and Smaller: Install raceways in maximum lengths of **50 feet (15 m)**.
 2. **1-Inch (25-mm)** Trade Size and Larger: Install raceways in maximum lengths of **75 feet (23 m)**.
 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where otherwise required by NFPA 70.
- M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed **30 deg F (17 deg C)**, and that has straight-run length that exceeds **25 feet (7.6 m)**.
1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: [**125 deg F (70 deg C)**] temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: [**155 deg F (86 deg C)**] temperature change.
 - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: [**125 deg F (70 deg C)**] temperature change.
 - d. Attics: [**135 deg F (75 deg C)**] temperature change.
 2. Install fitting(s) that provide expansion and contraction for at least **0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C)** of temperature change.
 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

- N. Flexible Conduit Connections: Use maximum of **72 inches (1830 mm)** of flexible conduit for **[recessed and semirecessed lighting fixtures,**]equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- P. Set metal floor boxes level and flush with finished floor surface.
- Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
1. **[Black letters on an orange field].**
 2. Legend: Indicate voltage.

- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, **2 inches (50 mm)** long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Write-On Tags: Polyester tag, [**0.010 inch (0.25 mm)**] [**0.015 inch (0.38 mm)**] thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
 - 1. **[Black letters on an orange field]**
 - 2. Legend: Indicate voltage
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; **2 inches (50 mm)** wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Write-On Tags: Polyester tag, [**0.010 inch (0.25 mm)**] [**0.015 inch (0.38 mm)**] thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, **2 inches (50 mm)** long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than **3 mils (0.08 mm)** thick by **1 to 2 inches (25 to 50 mm)** wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- D. Write-On Tags: Polyester tag, [**0.010 inch (0.25 mm)**] [**0.015 inch (0.38 mm)**] thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 FLOOR MARKING TAPE

- A. **2-inch- (50-mm-)** wide, **5-mil (0.125-mm)** pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.9 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be **3/8 inch (10 mm)**. Overlay shall provide a weatherproof and UV-resistant seal for label.
- B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be **3/8 inch (10 mm)**.
- C. Stenciled Legend: In nonfading, waterproof, [**black**] ink or paint. Minimum letter height shall be [**1 inch (25 mm)**].

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at **50-foot (15-m)** maximum intervals in straight runs, and at **25-foot (7.6-m)** maximum intervals in congested areas.
- G. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than [30] A, and [120] V to ground: Install labels at [**10-foot (3-m)**] [**30-foot (10-m)**] maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
 - 3. UPS.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase[**and Voltage Level**] Identification, 600 V or Less:

- a. Color shall be factory applied[**or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit**].
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of **6 inches (150 mm)** from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Conductors to Be Extended in the Future: Attach [**write-on tags**] to conductors and list source.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: [**Self-adhesive warning labels**]

1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum **3/8-inch- (10-mm-)** high letters for emergency instructions at equipment used for **[power transfer]**
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: **[Adhesive film label with clear protective overlay]**. Unless otherwise indicated, provide a single line of text with **1/2-inch- (13-mm-)** high letters on **1-1/2-inch- (38-mm-)** high label; where two lines of text are required, use labels **2 inches (50 mm)** high.
 - c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Receptacles with integral surge suppression units.
 - 4. Wall-box motion sensors.
 - 5. Isolated-ground receptacles.
 - 6. Hospital-grade receptacles.
 - 7. Snap switches and wall-box dimmers.
 - 8. Solid-state fan speed controls.
 - 9. Wall-switch and exterior occupancy sensors.
 - 10. Communications outlets.
 - 11. Pendant cord-connector devices.
 - 12. Cord and plug sets.
 - 13. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.
- B. Related Sections include the following:
 - 1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, [feed] [non-feed]-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.

SNAP SWITCHES

- C. Comply with NEMA WD 1 and UL 20.
- D. Switches, 120/277 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- E. Pilot Light Switches, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221PL for 120 V and 277 V.
 - b. Hubbell; HPL1221PL for 120 V and 277 V.
 - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
 - d. Pass & Seymour; PS20AC1-PLR for 120 V.
 - 3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- F. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995.
 - b. Hubbell; HBL1557.
 - c. Leviton; 1257.
 - d. Pass & Seymour; 1251.
 - e. **<Insert manufacturer's name; catalog number.>**

2.4 OCCUPANCY SENSORS

- A. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 6111 for 120 V, 6117 for 277 V.
 - b. Hubbell; WS1277.
 - c. Leviton; ODS 10-ID.
 - d. Pass & Seymour; WS3000.
 - e. Watt Stopper (The); WS-200.
 3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
- B. Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; AT120 for 120 V, AT277 for 277 V.
 - b. Leviton; ODS 15-ID.
 3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
- C. Long-Range Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATP1600WRP.
 - b. Leviton; ODWWV-IRW.
 - c. Pass & Seymour; WA1001.
 - d. Watt Stopper (The); CX-100.
 3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).
- D. Long-Range Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATD1600WRP.
 - b. Leviton; ODW12-MRW.
 - c. Watt Stopper (The); DT-200.

3. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft. (111 sq. m).

E. Wide-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATP120HBRP.
 - b. Leviton; ODWHB-IRW.
 - c. Pass & Seymour; HS1001.
 - d. Watt Stopper (The); CX-100-3.
 - e. <Insert manufacturer's name; catalog number.>
3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

2.5 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 3560-6.
 - b. Leviton; 40649.
3. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 3562.
 - b. Leviton; 40595.
3. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

2.6 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: [~~0.035-inch-~~ (1-mm-) **thick, satin-finished stainless steel**] [~~0.04-inch-~~ (1-mm-)]
 3. Material for Damp Locations: [**Cast aluminum**] with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant [, **die-cast aluminum**] with lockable cover.

2.7 FLOOR SERVICE FITTINGS

- A. Type: Modular, [**flush-type**], dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: [**Rectangular**] [**die-cast aluminum**] with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: [**Blank cover with bushed cable opening**]

2.8 MULTIOUTLET ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Incorporated; Wiring Device-Kellems.
 2. Wiremold Company (The).
- B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- C. Raceway Material: [**Metal, with manufacturer's standard finish**] [**PVC**].
- D. Wire: No. 12 AWG.

2.9 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
1. Wiring Devices Connected to Normal Power System: [**As selected by Architect**] unless otherwise indicated or required by NFPA 70 or device listing.

2.10 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than **6 inches (152 mm)** in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles [**up**], and on horizontally mounted receptacles to the [**right**].

- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
 - 1. Install dimmers within terms of their listing.
 - 2. Verify that dimmers used for fan speed control are listed for that application.
 - 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

2.11 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with **[black]** **[white]** **[red]**-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

2.12 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
 - 2. Test Instruments: Use instruments that comply with UL 1436.
 - 3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
 - 5. Retrofit kits for fluorescent lighting fixtures.
- B. Related Sections:

1.2 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
- C. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, [**provide one of the products indicated on Drawings**].

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Diffusers and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least **[0.125 inch (3.175 mm)]** <Insert dimension> minimum unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.

2.3 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
 - 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.4 EMERGENCY LIGHTING UNITS

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of [15] <Insert period> minutes when power is restored after an outage.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, [12 gage (2.68 mm)].
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, [12 gage (2.68 mm)]
- F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Comply with NFPA 70 for minimum fixture supports.
- C. Suspended Lighting Fixture Support:
 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Adjust aimable lighting fixtures to provide required light intensities.
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100