

**Shiprock Pinnacle  
Hotel and Restaurant**  
SHIPROCK, NAVAJO NATION, NEW MEXICO

**PROJECT MANUAL**

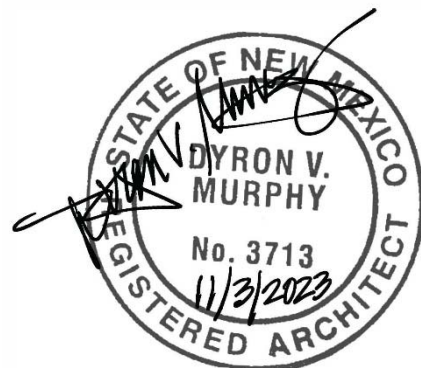
**100% CONSTRUCTION DOCUMENTS  
ISSUED FOR CONSTRUCTION**

**November 3, 2023**

DMA PROJECT No. 2022.10



DYRON MURPHY ARCHITECTS, P.C.  
4505 Montbel Place NE  
Albuquerque, New Mexico 87107  
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**SHIPROCK PINNACLE HOTEL AND RESTAURANT  
SHIPROCK, NEW MEXICO**

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**END OF SECTION**

## **INVITATION TO BID**

Navajo Nation Hospitality Enterprise (the "Owner"), invites General Contractors to submit bids for general construction of the Shiprock Pinnacle Hotel and Restaurant, at Shiprock, New Mexico.

The work includes new 85-room hotel, full service restaurant and kitchen, site improvements, site infrastructure, plumbing, mechanical & electrical work.

The construction contract will be awarded on a lump-sum basis. Procurement is subject to the Navajo Nation Business Preference Law; Title 5, Navajo Tribal Code, Section 201 through 218 and other applicable Navajo Nation Laws. Bids must be in accordance with Bid Documents prepared by the Project Architect, Dyron Murphy Architects, P.C., Albuquerque, NM, (505) 830-0203.

Bids shall be filed with the Owner by the deadline of December 21, 2023 by 2:00 PM MST at office of the Architect. Bids received after the deadline will not be accepted and returned. No faxed or emailed bids will be accepted.

Bid Documents may be obtained from ALBUQUERQUE REPROGRAPHICS, 4716 McCleod NE, Albuquerque, NM 87109, according to bid retrieval instructions on the ABQ Reprographics website: <https://www.arigraphix.com/>

Questions shall be addressed in writing to the Architect's office by email, to Rebecca Irvin, at [rirvin@dm-architects.com](mailto:rirvin@dm-architects.com).

The Owner reserves the right to reject any and all bids, to waive any informalities or irregularities when it is in the best interest of the Owner. Bids are valid for 120 calendar days upon submittal. Navajo Nation Hospitality Enterprise is not bound to enter into a contract under this ITB and may issue a subsequent ITB for the same services.

End of Invitation to Bid

## INSTRUCTIONS TO BIDDERS

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### **1.0** DEFINITIONS

**1.1** **PROJECT:** The Project consists of the construction of a new hotel and restaurant facility, as two independent structures, by a Bidder, for a Lump Sum Price agreed to by the most responsive Bidder and the Owner.

**1.2** **OWNER:** Navajo Nation Hospitality Enterprise (the "Owner"), Glendale, Arizona

Address: Navajo Nation Hospitality Enterprise  
6677 W. Thunderbird Road, Suite J176  
Glendale, Arizona 85306  
Telephone: (623) 412-0297  
Representative: Cindy Sapp, Owner

Will receive bids on or before December 21, 2023 by 2:00 PM MST from General Contractors at the office of the Architect, at the address shown below.

**1.3** **ARCHITECT/ENGINEER:** Professional firm retained by the Owner to assist in development of the Project whose responsibilities includes:

- a. Review of Bids submitted in accordance with Bid Documents.
- b. Review of design information submitted by Bidders.
- c. Provides recommendations of technical nature to Owner regarding design and construction matters.
- d. Issues Bid Documents and makes clarifications, issues addenda, reviews requests for substitutions, and/or receives bids.
- e. Issues relevant design data, e.g., drawings or specifications for project.
- f. Assists Owner in contract issuance and negotiations with selected successful Bidder.
- g. Provides Construction Administration and Observation services on behalf of Owner during construction.
- h. Assists Owner during contract closeout procedures.
- i. Assists Owner during conferences and meetings prior to receipt of Bids, during contract negotiations, and during construction.
- j. Reviews and approves construction submittals.
- k. Reviews and approves construction pay requests.

Address: Dyron Murphy Architects, PC  
4505 Montbel PL NE  
Albuquerque, New Mexico 87107  
Telephone: (505) 830-0203, Fax: (505) 830-0237  
Representative: Rebecca Irvin, Project Manager

**1.4** **BIDDER:** A builder, contractor, or developer acting as the primary agent responsible for submitting a bonafide written Bid for a prime contract with the Owner for the Project described in the Proposed Contract Documents. The Bid shall include all required costs,



e.g., labor, travel, materials, overhead expense, profit, and related costs to provide complete construction services associated with the development of the Project. The Bidder shall be responsible for administering all aspects of the work and contract requirements. A representative shall be designated to act on behalf of the Bidder to enter into agreements, provide direction, and adjudicate matters related to construction issues under the contract.

- 1.5 BID DOCUMENTS:** General documents which are issued by the Owner and describe the process for executing the Project, include, but are not limited to the following:

**CONTRACT DOCUMENTS:**

- a. Invitation to Bid
- b. Instructions to Bidders.
- c. Bid Form.
- d. Subcontractor List Form.
- e. Agreement Forms.
- f. Wage Rate Determination.

**TECHNICAL PROVISIONS**

- a. Project Drawings.

- 1.6 ADDENDA:** Written or graphic instruments issued by the Architect prior to the submission of Bids which modify or interpret the Bid Documents by additions, deletions, clarifications or corrections.

- 1.7 BID:** A complete and properly signed Bid to complete the Project for the Lump Sum Price agreed upon therein, supported by information or forms called for by the Bid and Contract Documents. The Bid shall include the following submittal documents in order to be considered for this contract:

- a. Bid Form, noting 3 distinct bid amounts and Value Engineering bids, signed and sealed, including breakdown in the form of Schedule of Values for each bid price option, by CSI Division that corresponds to the scope of work, and acknowledgement of receipt of Addenda, if applicable.
- b. Bid Bond in amount of 10% of Bid entered, including Name and Address of bonding company, and limits of Bonding at time of Bid Submittal.
- c. Power of Attorney, if necessary.
- d. Evidence of General Construction Licensure for the State of New Mexico, including active dates.
- e. Certification from the Navajo Nation Business Regulatory Department, indicating level of Preference, if claimed.
- e. Subcontractor's List Form indicating Navajo-owned companies, if applicable.
- f. Certificates of General Liability and Workman's Compensation Insurance, indicating coverage amounts, both Aggregate and Per Incident.
- g. Affidavit of Non-Collusion, notarized.

**2.0 BIDDER'S REPRESENTATION**

- 2.1** Each Bidder by making his/her Bid represents that:

- A. He/she has read and understands the Bid Documents and their Bid is made in accordance within.
- B. He/she have visited the site and have familiarized him/her with the local conditions under which the Project is to be performed.
- C. His/her Bid is based upon the materials, labor, transportation, systems and equipment proposed in his/her interpretations and assumptions described by his/her design submittal as part of his/her Bid, and other pertinent information contained in the Bid Documents.

### **3.0 BID DOCUMENTS**

**3.1 Copies:** Bidders may obtain sets of the Bid Documents for the deposit sum, and at the location stated in the Invitation to Bid. The deposit will be refunded as stipulated in the Invitation to Bid. A Bidder receiving a contract award may retain the Bid Documents and his/her deposit will be refunded.

- A. Information contained in the Bid Documents shall be used by the Bidder in preparation of his/her Bid pricing and construction documents; neither the Owner nor the Architect assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bid Documents.
- C. The Owner or the Architect, in making copies of the Bid Documents available on the above items, do so only for the purpose of obtaining Bids on the Project and do not confer a license or grant for any other use.

### **3.2 Interpretation or Correction of Bid Documents**

- A. Bidders shall promptly notify the Architect of any ambiguity, inconsistency or error, which they may discover upon examination of the Bid Documents, or of the site and local conditions.
- B. Bidders requiring clarification or interpretation of the Bid Documents shall make a written request to the Architect at least ten (10) calendar days prior to the date for receipt of Bids. Requests for clarification received less than ten (10) days before the date for receipt of Bids will not be addressed by the Owner or Architect.
- C. Any interpretation, correction or change of the Bid Documents will be made by Addendum. Interpretations, corrections or changes of Bid Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections or changes.

### **3.3 Substitutions**

- A. The materials, products and equipment described in the Bid Documents establish a standard of required performance, function, dimension, appearance and quality to be met by any proposed substitution. Materials, products, or equipment by other manufacturers and vendors deemed to adequately perform the duties imposed by the general design intent will be considered equally acceptable provided the material, equipment, or product so proposed is, in the opinion of the Architect, of equal performance and function. The burden of proof of the merit of the proposed substitute is upon the Bidder. The Architect's decision of approval or disapproval, after consultation with the Owner, of a proposed substitution shall be final. No

substitution shall be purchased or installed by the Contractor without the Architect's written approval.

- B. It shall be the responsibility of the Bidder to provide and pay for all modifications that may be required of other trades, which may add to their costs, brought about by substitutions and/or options after the contract has been let. No additional costs shall be assessed to the Owner.
- C. Substitution Bids which deviate from those materials, equipment, or products described in the Bid Documents shall be noted on the drawings or proposed method of construction in the Bidders Bid package.
- D. A request for a substitution constitutes a representation that the Bidder:
  - 1. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
  - 2. Will provide the same warranties or bonds for the substitution as for the product specified.
  - 3. Will coordinate the installation of any accepted substitution into the Project and make such other changes as may be required to make the Project complete in other respects.
  - 4. Will not increase the maximum contract price. Where substitutions of materials are deemed acceptable and are of lesser value than the established standards, a cost credit from the Bidder to the Owner shall be applied to the maximum contract price.

### **3.4 ADDENDA**

- A. All who are known by the Architect to have received a complete set of Bid Documents will be notified of any Addenda issuance and place of availability for pickup. The Bidder shall provide a working fax number and/or email address where addenda may be transmitted for receipt by the Bidder.
- B. Copies of Addenda will be made available for inspection wherever Bid Documents are on file for that purpose.
- C. No Addenda will be issued later than four (4) days prior to the date for receipt of Bids except an Addendum, if necessary, postponing the date for receipt of Bids or withdrawing the request for Bids.
- D. Each Bidder shall ascertain, prior to submitting his/her Bid, which he/she has received all Addenda issued, and he/she shall acknowledge receipt of all issued Addenda on the Form of Bid.

## **4.0 BID PROCEDURE**

### **4.1 Form and Style of Bids**

- A. Bids shall be submitted on the form(s) provided in the Bid Documents.
- B. All blanks on the Bid Form shall be filled in by typewriter or legibly in ink.
- C. Where so indicated by the makeup of the Bid Form, sums shall be expressed in both words and figures, and in case of discrepancy between the two, the written amount shall govern.
- D. Any interlineation, alteration or erasure must be initialed by the signer of the Bid.
- E. Bidders shall make no additional stipulations on the Bid Form, nor qualify his/her Bid in any other manner.

- F. Each Bid shall include the legal name of the Bidder and a statement whether the Bidder is a sole proprietor, a partnership or a corporation, or any other legal entity and shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further list the State of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current Power of Attorney attached certifying the agent's authority to bind Bidder.
- G. In review of the construction documents, the Bidder shall provide suggested Value Engineering costs to reduce costs of construction for each of the three (3) Base Bid amounts indicated on the Bid Form. The amount indicated for the Value Engineering amount shall equate to the Base Bid amount less the suggested Value Engineering amount, including applicable taxes. Include a list of suggested items and their values with the Bid Form.

#### 4.2 Bid Security

- A. Each Bid shall be accompanied by a Bond or Cashier's Check in the required form and amount pledging that the Bidder will enter into a Contract with the Owner on the terms stated in his/her Bid and will furnish bonds as described hereunder in Article 8 covering the faithful performance of the Contract and the payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds, the amount of the Bid Bond shall be forfeited to the Owner as liquidated damages, not as a penalty.
- B. The Bond shall be prepared on the forms in the Bid Document, issued by a surety licensed to do business in the State of New Mexico listed on the current U.S. Treasury Surety List and acceptable to the Owner. The Attorney-In-Fact that executes the Bond on behalf of the Surety shall affix to the Bond a certified and current copy of his Power of Attorney.
- C. The Owner will have the right to retain the Bid Security of Bidders until either (a) the Contract, has been executed and bonds have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

#### 4.3 Submission of Bids

- A. All copies of the Bid, the Bid Security and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed as follows:

Dyron Murphy Architects, PC  
Attn: Dyron V. Murphy, AIA  
4505 Montbel Place NE  
Albuquerque, New Mexico 87107

**Bid Package for the  
SHIPROCK PINNACLE HOTEL & RESTAURANT  
DO NOT OPEN**

If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "BID ENCLOSED" on the face, thereof. The

Owner assumes no responsibility for Bids delivered after the time and date of the Bid opening.

- B. Bids shall be deposited at the designated location prior to the time and date for receipt of Bids indicated in the Invitation to Bid, or any extension thereof made by Addendum. Bids received after the time and date for receipt of Bids will be returned unopened.
- C. Oral, telephonic, telegraphic, emailed, or faxed Bids are invalid and will not be considered.
- D. Failure to include all required Bid Documents as stipulated will be cause for disqualification.

#### **4.4 Modification or Withdrawal**

- A. A Bid may not be modified, withdrawn, or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and Bidder so agrees in submitting the Bid.
- B. Bids submitted early may be modified or withdrawn prior to the time designated for receipt of Bids.
- C. Withdrawn Bids may be resubmitted up to the time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

#### **4.5 Owner's Bid Declarations**

- A. It is the intent of the Owner to award a contract to the most qualified responsible Bidder, provided Bid has been submitted in accordance with the requirements of the Bid Documents and does not exceed the funds available. The Owner shall have the right to take such steps, as it deems necessary to determine the ability of the Bidder to perform the Project. Bidders shall furnish to the Owner such additional information and data for purpose as Owner may request. Owner reserves the right to reject any or all Bids that in the Owner's sole judgment are in the Owner's best interest.

#### **4.6 Pre-Bid Conference**

- A. It remains the responsibility of the Bidder to exhibit due diligence in determining specific criteria and requirements related to this Bid procurement process and submittal. No Pre-Bid Conference has been scheduled, and if the Bidder wishes to examine the existing site conditions, they may do so by coordinating with the Owner's representative as listed under Part 1.2.

### **5.0 CONSIDERATION OF BIDS**

#### **5.1 Receipt of Bids**

- A. Bids will be received at the Architect's office, on the date and time specified on the Invitation to Bid. The Bids will be evaluated by the Architect thereafter to determine compliance with the bid documents.

#### **5.2 Rejection of Bids**

- A. The Owner has the right to reject any or all Bids, reject a Bid not accompanied by any required Bid Security, or data required by the Bid Documents or a Bid, which is in any way incomplete or irregular. Conditional Bids will not be accepted.

### **5.3 Acceptance of Bid**

- A. The Owner has the right to waive any informality or irregularity in any Bid received.
- B. It is the intent of the Owner to award a Contract to the most qualified responsible Bidder provided the Bid has been submitted in accord with the requirements of the Bid Documents and is judged to be reasonable.
- C. If the Bid is within the amount of the funds available to finance the construction contract, then the contract award will be made to that responsible Bidder submitting the low Bid.

## **6.0 SUB-BIDDERS**

### **6.1 Listing of Subcontractors and Suppliers**

- A. The Bidder shall list the Subcontractors or material suppliers they propose to use for all trades or items supplied, on the "Subcontractor List Form" attached.
  - 1. The Bidder shall not list itself as the supplier or the Subcontractor for any trade unless he has previously performed Project of this type or can prove to the Architect's satisfaction that he/she actually has, or will obtain, fully adequate facilities and plans to perform the Project with his/her own forces.
  - 2. Omission or non-compliance with the intent of the "Subcontractor List Form" will be grounds for considering a Bid as non-responsive.
  - 3. The Bidder will, upon request, be required to establish to the satisfaction of the Architect and the Owner the reliability and responsibility of the proposed Subcontractors to furnish and perform the Project described in the Sections of the Specifications pertaining to the proposed Subcontractors respective trades.
  - 4. Prior to the award of the Contract, the Architect will notify the Bidder, in writing, if either the Owner, after due investigation, has reasonable and substantial objection to any person or organization on such list. If the Owner has a reasonable and substantial objection to any person or organization on such list, and refuses in writing to accept such person or organization, the Bidder may, at their option, (1) withdraw their Bid, or (2) submit an acceptable substitute Subcontractor with no increase in the Bid price. In the event of withdrawal under this Subparagraph, Bid Security will not be forfeited, notwithstanding anything to the contrary in Paragraph above.
- B. Subcontract awards shall be bound with the provisions outlined in the "Labor and Wage Standards", contained in the Contract Conditions section of the Bid Package.

## **7.0 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND**

### **7.1 Security for Faithful Performance**

- A. The Bidder shall furnish and maintain bonds covering the faithful performance of the Contract, and the payment of all obligations arising thereunder, in an amount equal to one hundred percent (100%) of the Contract Sum as adjusted, and with such sureties secured through the Bidder's usual sources, licensed to do business in the State of New Mexico and as may be agreeable to the parties.

## **7.2 Time of Delivery and Form of Bonds**

- A. The Bidder shall deliver the required bonds to the Owner within ten (10) calendar days of receipt of written notice of award. If the Project must commence prior thereto, in response to a letter of Notice to Proceed from the Owner, the Bidder shall, prior to commencement of Project, submit evidence satisfactory to the Owner that such bonds will be furnished.
- B. The bonds shall be written on the form(s) described under Bid Contract Documents.
- C. The Bidder shall require the Attorney-In-Fact that executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his/her Power of Attorney.

## **7.3 Taxes**

- A. It is understood that the stipulated sum or contract amount will not include the cost of state and local taxes. Navajo Tribal Taxes will be required. The Bidder shall make certain of any applicable Navajo Tribal Taxes be included in the Bid. The Bidder shall make inquiries to the Navajo Tax Commission, Window Rock, Arizona (928) 871-7610.

## **7.4 Arbitration**

- A. The "Arbitration" clauses or references in the General Conditions of the Contract for Construction (AIA Document A201) shall apply to this project.

## **7.5 Claims and Disputes**

- A. Any claims, disputes and other matters in question between the parties to this Agreement, shall be referred to the Architect by written notice within three (3) weeks of the date when the claim, dispute or other matter in question became known or should have become known to the complaining party.
- B. Resolution shall be made between parties according to the Arbitration clauses set forth in the General Conditions of the Contract for Construction, unless otherwise noted.

## **7.6 Acknowledgments**

- A. This Agreement represents the entire and integrated Agreement between Owner and Contractor and supersedes all prior negotiations, representations or Agreements, either written or oral. This Agreement may be amended only by written instrument signed by both Owner and Contractor.

## **8.0 SPECIAL BINDING AND CONTRACT PROVISIONS**

## **8.1 Submission Materials**

- A. Letter of certification from the Bidder, attesting to Bidder's compliance with Navajo Nation Wage and Labor Standards as stipulated in the Bid Documents.
- B. Identification (Names, addresses, and telephone numbers) of declared Indian laborers or subcontractors for the Project to be performed, and the appropriate percentage (%) of total workforce in relation to the proposed Bid amount.

## **9.0 FORM OF AGREEMENT BETWEEN OWNER AND BIDDER**

### **9.1 Form to be Used**

- A. The Agreement for the Project will be written on the forms indicated under the Bid Contract Documents.

## **10.0 LIQUIDATED DAMAGES**

### **10.1 Time of Completion**

- A. Bidder must agree to commence Project on a date specified in a written "Notice to Proceed" issued by the Owner. The Bidder must agree to complete the Project within 450 calendar days commencing on the date of the "Notice to Proceed".

### **10.2 Assessment**

- A. Liquidated Damages will be assessed on this project at a rate of \$ 2,500.00 per calendar day beyond the contract time agreed upon in the contract documents, unless amended due to delays beyond the control of the Bidder and/or Owner.

## **11.0 MISCELLANEOUS PROVISIONS**

### **11.1 Permits and Fees**

- A. Contractor shall pay for all permits and fees applicable to the project that is required by Government, State and Local municipalities.
- B. Bidder's attention is drawn to the Navajo Nation Gross Receipts Tax documents attached herein, for regulations and requirements related to business activities on the Navajo Reservation.

**END OF INSTRUCTIONS TO BIDDERS**



**BID FORM**

**PROJECT NAME: Shiprock Pinnacle Hotel & Restaurant  
Shiprock, Navajo Nation, New Mexico  
Architect's Project No. 2022.10**

**Bid Submittal Date: December 21, 2023**

To: Navajo Nation Hospitality Enterprise (hereinafter called the "Owner").

Bidder Name/Entity: \_\_\_\_\_

The Bidder, organized and existing under the laws of the State of \_\_\_\_\_, doing business as a Corporation, Partnership or Individual. (Identify organization structure).

The undersigned Bidder's representative acknowledges receipt of the following Addenda, if applicable:

Addendum No: \_\_\_\_, dated \_\_\_\_\_, Addendum No: \_\_\_\_, dated \_\_\_\_\_

Addendum No: \_\_\_\_, dated \_\_\_\_\_, Addendum No: \_\_\_\_, dated \_\_\_\_\_

**Bid amount submittal requirement:** Amounts to be shown in both words and figures. In case of a discrepancy, the amount shown in words will govern, please print.) All sums must include Navajo Nation Tax, including all permits and fees if required by authorities having jurisdiction.

<b>Total Base Bid #1, Hotel Project:</b>	
	/Dollars/Cents
\$	
Navajo Nation Tax Amount, Included in Base Bid Amount:	
\$	
Bid 1 Value Engineering Reduction:	\$
<b>Total Base Bid #2, Restaurant Project:</b>	
	/Dollars/Cents
\$	
Navajo Nation Tax Amount, Included in Base Bid Amount:	
\$	

Bid 2 Value Engineering Reduction:	\$
------------------------------------	----

<b>Total Base Bid #3, Hotel and Restaurant Project:</b>	
/Dollars/Cents	
\$	
Navajo Nation Tax Amount, Included in Base Bid Amount:	
\$	
Bid 3 Value Engineering Reduction:	\$

The undersigned, as an authorized representative for the Bidder named above, in compliance with the Invitation to Bid for the Project identified above having examined the Bid Documents, and having examined the site of the proposed work, and being familiar with all of the conditions surrounding the construction of the proposed project, including the availability of labor, materials and supplies, hereby proposes to furnish all labor, materials and supplies, and to construct the project in accordance with the contract documents at the prices stated herein. These prices are to cover all expenses incurred in performing the work required under the contract documents, of which this proposal is a part.

The Bidder understands that the contract will be awarded in accordance with the provisions of the Instructions to Bidders and that the Owner reserves the right to reject any or all bids and to waive any formalities in the bid process.

The Bidder agrees that this bid shall be good and may not be withdrawn for a period of One Hundred and Twenty (120) calendar days after the scheduled closing time for receiving bids.

Upon receipt of written notice of acceptance of this bid, Bidder will execute the final contract and deliver surety bonds as stipulated in the "Instructions to Bidders".

The BID SECURITY attached in the sum of 10% of the bid amount is:

\_\_\_\_\_ Dollars,

(\$ \_\_\_\_\_)

and shall become the property of the Owner in the event the contract and bonds are not executed within the time set forth herein, as liquidated damages for the delay and additional expenses to the Owner caused thereby.

Respectfully Submitted,

By: \_\_\_\_\_  
Authorized Agent (Typed/Printed)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Company Name

\_\_\_\_\_  
Company Address

Telephone: \_\_\_\_\_

(Affix Corporate Seal if bid by Corporation)

**BID BOND**

KNOW ALL MEN BY THESE PRESENTS, That we the undersigned,

\_\_\_\_\_  
(Name of Principal)

as PRINCIPAL, and

\_\_\_\_\_, as SURETY are held and  
(Name of Surety)

firmly bound unto NAVAJO NATION HOSPITALITY ENTERPRISE, hereinafter called the "Owner", in the penal sum of \$\_\_\_\_\_ Dollars, lawful money of the United States, for the payment of which sum will and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITIONS OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the accompanying bid dated December 21, 2023 for the Shiprock Pinnacle Hotel & Restaurant Project.

NOW, THEREFORE, if the Principal shall not withdraw said bid within the period specified therein after the opening of the same, or if no period be specified, within one hundred twenty (120) days after said opening, and shall within the period specified therefore, or, if no period be specified within ten (10) days after the prescribed forms are presented to for signature, enter into a written contract with the Owner in accordance with the bid as accepted, and give the required performance and payment security, for the faithful performance and proper fulfillment of such contract; or in the event of the withdrawal of said bid within the period specified, or the failure to enter into such contract and give such security within the time specified, if the Principal shall pay the Owner the difference between the amount specified in said bid and the amount for which the Owner may procure the required work or supplies or both, if the latter amount to be in excess of the former, then the above obligation shall be a void and of no effect, otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals this \_\_\_\_\_ day of \_\_\_\_\_, 2023, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In presence of

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
(Individual Principal) (SEAL)  
(Business Principal)

ATTEST:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
(Corporate Principal)

(Business Address)

BY: \_\_\_\_\_

Affix Corporate Seal

ATTEST:

\_\_\_\_\_

\_\_\_\_\_  
(Corporate Surety)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
(Business Address)

BY: \_\_\_\_\_

Affix Corporate Seal

\_\_\_\_\_  
\_\_\_\_\_  
(Power of Attorney for person signing for Surety Company must be attached to Bond)

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, \_\_\_\_\_, certify that I am the \_\_\_\_\_ (Title)  
of the Corporation named as Principal in the within Bond; that \_\_\_\_\_, who signed the said  
Bond on behalf of the Principal was then \_\_\_\_\_, of said Corporation; that I know his  
signature, and his signature thereto is genuine; and that said Bond was duly signed, sealed, and  
attested to for and in behalf of said corporation by authority of its governing body.

\_\_\_\_\_ (Corp. Seal)

**SUBCONTRACTOR LIST FORM**

**1. GENERAL:**

- A. The Contractor must list below the name and address of all qualified Subcontractor's or suppliers he/she will employ for the various portions of the work indicated. Failure on the part of the Contractor to complete or properly complete this list will constitute sufficient grounds to reject his/her bid. Additionally, the Contractor shall declare whether subcontractors listed herein are Navajo or Non-Navajo Owned businesses.
  
- B. The Contractor may list him/herself to perform one or more of the listed categories of work for which he has any requisite state licenses when required. In this case, all personnel performing such work at the site shall be carried on his/her own payroll, except that he/she may sublet those portions of the work that are traditionally and commonly sublet by the representative Subcontractor in the community. If equipment is leased with operators, the operators need not be carried on the Contractor's payroll.
  
- C. List only a single name for each listing. If a change occurs in the list, brought about by the exercising of any of the alternates involved in the Bid Form, the Bidder must show this change on the list. If no name appears other than those listed under the base bid, adherence to those names will be required no matter which alternate, if any, is exercised.

**2. TRADES**

TRADE	SUBCONTRACTOR/SUPPLIER NAME/ADDRESS	Navajo-Owned? Y/N
Concrete		
Reinforced Masonry		
Rough Carpentry		
PreEng Wood Trusses		
Architectural Woodwork		
Insulation		
Roof Shingles		
Doors/Windows		
Door Hardware		
Gypsum Board Assemblies		
Acoustical Ceilings		
Carpet Tile		
Painting		
Fire Protection Specialties		

Plumbing-Site		
Plumbing-Building		
HVAC		
Electrical-Site		
Electrical- Building		
Earthwork		
Asphalt Paving		
Concrete Paving		
Fencing		
Site Utilities		
Other (specify)		

**END OF SUBCONTRACTOR LIST FORM**

**AFFIDAVIT OF NON-COLLUSION**

for Construction of the

**Shiprock Pinnacle Hotel & Restaurant**

located in the **Shiprock** Chapter of the Navajo Nation, State of New Mexico, San Juan County

To the Owner: Navajo Nation Hospitality Enterprise

Affiant: \_\_\_\_\_, being first duly sworn, hereby deposes and says:  
Printed Name

1. that he/she is the \_\_\_\_\_ of \_\_\_\_\_ the Business Entity  
owner, partner, officer, representative agent      company, firm, partnership, etc.  
that has submitted/is submitting to the Owner, a Bid Proposal for the above-named Project;
2. that Affiant is fully informed with respect to the preparation and contents of the Bid submitted by said Business Entity for the above-named Project, and with respect to all pertinent circumstances regarding the submission of said Bid to the Owner;
3. that he/she is authorized to represent said Business Entity for purposes of the declarations set forth herein, and that all such declarations are made on behalf of said Entity and all of its owners, partners, officers, members, employees, officials, agents, or parties-in-interest;
4. that said Bid is genuine and not collusive or sham;
5. that said Entity has not in any manner colluded, conspired, connived, or agreed, directly or indirectly, with any other entity, bidder, or person, to submit a sham Bid to the Owner in connection with the proposed Contract for which said Bid was submitted, or to refrain from submitting a Bid to the Owner in connection with the proposed Contract;
6. that said Entity has not in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference, with any other entity, bidder, or person, to fix any price or fee relating to any Bid of Entity or of any other entity, bidder, or person, or to fix any price, overhead, profit, reimbursement, or cost element of said Bid, or of that of any other entity, bidder, or person;
7. that said Entity has not -through any collusion, conspiracy, connivance, or unlawful written or oral agreement- secured any advantage against the Owner or against any other entity, bidder or person interested in the proposed Contract for the above-named Project;
8. that all statements set forth herein, and in said Bid submitted to the Owner, are true.

Signature of Affiant:

\_\_\_\_\_

Address of Business Entity:

\_\_\_\_\_

\_\_\_\_\_

**NOTARY:**

Subscribed and sworn to before me this \_\_\_\_\_  
day of \_\_\_\_\_, 20\_\_\_\_.

Notary Signature

\_\_\_\_\_

My Commission Expires

\_\_\_\_\_, 20\_\_\_\_.



# DRAFT AIA® Document A101® - 2017

## Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

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

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

« »  
« »  
« »  
« »

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

« »  
« »  
« »  
« »

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

« »  
« »  
« »

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

« »  
« »  
« »  
« »

The Owner and Contractor agree as follows.

**ADDITIONS AND DELETIONS:** The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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

The parties should complete A101®-2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®-2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

**ELECTRONIC COPYING** of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

## TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS
- 2 THE WORK OF THIS CONTRACT
- 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- 4 CONTRACT SUM
- 5 PAYMENTS
- 6 DISPUTE RESOLUTION
- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS

### EXHIBIT A INSURANCE AND BONDS

#### ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

#### ARTICLE 2 THE WORK OF THIS CONTRACT

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

#### ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

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

*(Check one of the following boxes.)*

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

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

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

#### § 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

*(Check one of the following boxes and complete the necessary information.)*

[ « » ] Not later than « » ( « » ) calendar days from the date of commencement of the Work.

[ « » ] By the following date: « »

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

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

#### ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « » (\$ « » ), subject to additions and deductions as provided in the Contract Documents.

#### § 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement. (Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum: (Identify each allowance.)

Item	Price

#### § 4.4 Unit prices, if any:

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

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

#### § 4.5 Liquidated damages, if any:

(Insert terms and conditions for liquidated damages, if any.)

« »

#### § 4.6 Other:

(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

« »

## ARTICLE 5 PAYMENTS

### § 5.1 Progress Payments

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

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

« »

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

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

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- .1 That portion of the Contract Sum properly allocable to completed Work;
- .2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- .1 The aggregate of any amounts previously paid by the Owner;
- .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- .5 Retainage withheld pursuant to Section 5.1.7.

### § 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

*(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)*

« »

§ 5.1.7.1.1 The following items are not subject to retainage:  
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

<< >>

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:  
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

<< >>

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:  
(Insert any other conditions for release of retainage upon Substantial Completion.)

<< >>

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

## § 5.2 Final Payment

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

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.

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

<< >>

## § 5.3 Interest

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

<< >> % << >>

## ARTICLE 6 DISPUTE RESOLUTION

### § 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.  
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

<< >>

<< >>

<< >>

<< >>

**§ 6.2 Binding Dispute Resolution**

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:

*(Check the appropriate box.)*

Arbitration pursuant to Section 15.4 of AIA Document A201–2017

Litigation in a court of competent jurisdiction

Other *(Specify)*

<< >>

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

**ARTICLE 7 TERMINATION OR SUSPENSION**

**§ 7.1** The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

**§ 7.1.1** If the Contract is terminated for the Owner’s convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:

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

<< >>

**§ 7.2** The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

**ARTICLE 8 MISCELLANEOUS PROVISIONS**

**§ 8.1** Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

**§ 8.2** The Owner’s representative:  
*(Name, address, email address, and other information)*

<< >>  
<< >>  
<< >>  
<< >>  
<< >>  
<< >>

**§ 8.3** The Contractor’s representative:  
*(Name, address, email address, and other information)*

<< >>  
<< >>  
<< >>  
<< >>  
<< >>  
<< >>

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

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™-2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™-2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201-2017, may be given in accordance with AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

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

« »

§ 8.7 Other provisions:

« »

**ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS**

§ 9.1 This Agreement is comprised of the following documents:

- .1 AIA Document A101™-2017, Standard Form of Agreement Between Owner and Contractor
- .2 AIA Document A101™-2017, Exhibit A, Insurance and Bonds
- .3 AIA Document A201™-2017, General Conditions of the Contract for Construction
- .4 AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:

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

« »

- .5 Drawings

Number	Title	Date

- .6 Specifications

Section	Title	Date	Pages

- .7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

- .8 Other Exhibits:  
*(Check all boxes that apply and include appropriate information identifying the exhibit where required.)*

[ « » ] AIA Document E204™-2017, Sustainable Projects Exhibit, dated as indicated below:  
(Insert the date of the E204-2017 incorporated into this Agreement.)

« »

[ « » ] The Sustainability Plan:

Title	Date	Pages

[ « » ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

9 Other documents, if any, listed below:

*(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™-2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)*

« »

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

\_\_\_\_\_  
**OWNER** (Signature)

« »

\_\_\_\_\_  
(Printed name and title)

\_\_\_\_\_  
**CONTRACTOR** (Signature)

« »

\_\_\_\_\_  
(Printed name and title)



## **CONTRACT FORMS, BONDS AND CERTIFICATES**

Contract Forms anticipated to be utilized on this project, unless otherwise declared, are listed below.

1. AIA Document A101-2017 Ed., "Standard Form of Agreement Between Owner and Contractor" - To be executed by the Owner with the successful bidder.
2. AIA Document A201™–2017 "General Conditions of the Contract for Construction" - To be executed by the Owner with the successful bidder.
3. AIA Document A312™–2010 "Performance Bond and Payment Bond" - for 100% of the contract amount to be executed by the Contractor.
4. AIA Document G702™–1992 "Application and Certificate for Payment" -Executed by the Contractor, submitted each payment period as specified in the contract.
5. AIA Document G704™–2000 "Certificate of Substantial Completion"
6. AIA Document G706™–1994 "Contractor's Affidavit of Payment of Debts and Claims"
7. AIA Document G710™–1992 "Architect's Supplemental Instructions"

## **END OF FORMS, BONDS AND CERTIFICATES**

# DRAFT AIA® Document A201® - 2007

## General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

<< >>  
<< >>

THE OWNER:

(Name, legal status and address)

<< >><< >>  
<< >>

THE ARCHITECT:

(Name, legal status and address)

<< >><< >>  
<< >>

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- 14 TERMINATION OR SUSPENSION OF THE CONTRACT
- 15 CLAIMS AND DISPUTES

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## **ARTICLE 1 GENERAL PROVISIONS**

### **§ 1.1 BASIC DEFINITIONS**

#### **§ 1.1.1 THE CONTRACT DOCUMENTS**

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

#### **§ 1.1.2 THE CONTRACT**

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

#### **§ 1.1.3 THE WORK**

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

#### **§ 1.1.4 THE PROJECT**

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

#### **§ 1.1.5 THE DRAWINGS**

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

#### **§ 1.1.6 THE SPECIFICATIONS**

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

#### **§ 1.1.7 INSTRUMENTS OF SERVICE**

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

#### **§ 1.1.8 INITIAL DECISION MAKER**

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

### **§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS**

**§ 1.2.1** The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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

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

### § 1.3 CAPITALIZATION

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

### § 1.4 INTERPRETATION

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

### § 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

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

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

### § 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

## ARTICLE 2 OWNER

### § 2.1 GENERAL

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

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

### § 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner’s obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner’s ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the

portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

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

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

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

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

### § 2.3 OWNER'S RIGHT TO STOP THE WORK

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

### § 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

## ARTICLE 3 CONTRACTOR

### § 3.1 GENERAL

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

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

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

## § 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

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

## § 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

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

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

## § 3.4 LABOR AND MATERIALS

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

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

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

### § 3.5 WARRANTY

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

### § 3.6 TAXES

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

### § 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

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

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

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

§ 3.7.4 **Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

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

## § 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

## § 3.9 SUPERINTENDENT

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

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

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

## § 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

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

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

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

## § 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

### § 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

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

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

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

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

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

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

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

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and



completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

### § 3.13 USE OF SITE

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

### § 3.14 CUTTING AND PATCHING

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

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

### § 3.15 CLEANING UP

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

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

### § 3.16 ACCESS TO WORK

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

### § 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

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

### § 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

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

## ARTICLE 4 ARCHITECT

### § 4.1 GENERAL

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

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

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

### § 4.2 ADMINISTRATION OF THE CONTRACT

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

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

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

### § 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

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

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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

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

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

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

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

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

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

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

## ARTICLE 5 SUBCONTRACTORS

### § 5.1 DEFINITIONS

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

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

## § 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

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

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

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

## § 5.3 SUBCONTRACTUAL RELATIONS

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

## § 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

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

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

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

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the

Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

## **ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**

### **§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS**

**§ 6.1.1** The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

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

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

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

### **§ 6.2 MUTUAL RESPONSIBILITY**

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

**§ 6.2.2** If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

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

**§ 6.2.4** The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

**§ 6.2.5** The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

### **§ 6.3 OWNER'S RIGHT TO CLEAN UP**

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

## ARTICLE 7 CHANGES IN THE WORK

### § 7.1 GENERAL

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

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

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

### § 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

### § 7.3 CONSTRUCTION CHANGE DIRECTIVES

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

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

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

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

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

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount

for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 Additional costs of supervision and field office personnel directly attributable to the change.

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

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

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

#### § 7.4 MINOR CHANGES IN THE WORK

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

### ARTICLE 8 TIME

#### § 8.1 DEFINITIONS

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

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

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

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

#### § 8.2 PROGRESS AND COMPLETION

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

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

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

### § 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

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

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

## ARTICLE 9 PAYMENTS AND COMPLETION

### § 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

### § 9.2 SCHEDULE OF VALUES

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

### § 9.3 APPLICATIONS FOR PAYMENT

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

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

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

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



encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

#### **§ 9.4 CERTIFICATES FOR PAYMENT**

**§ 9.4.1** The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

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

#### **§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION**

**§ 9.5.1** The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

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

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

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

#### **§ 9.6 PROGRESS PAYMENTS**

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

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

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

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

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

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

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

## § 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

## § 9.8 SUBSTANTIAL COMPLETION

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

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

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

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

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

### **§ 9.9 PARTIAL OCCUPANCY OR USE**

**§ 9.9.1** The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

**§ 9.9.2** Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

**§ 9.9.3** Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

### **§ 9.10 FINAL COMPLETION AND FINAL PAYMENT**

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

**§ 9.10.2** Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

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

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

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

## ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

### § 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

### § 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

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

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

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

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

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

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

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

### § 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

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

### § 10.3 HAZARDOUS MATERIALS

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

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

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

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

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

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

## § 10.4 EMERGENCIES

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

## ARTICLE 11 INSURANCE AND BONDS

### § 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

### § 11.2 OWNER'S LIABILITY INSURANCE

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

### § 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

### § 11.3.2 BOILER AND MACHINERY INSURANCE

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

### § 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment

property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

#### § 11.3.7 WAIVERS OF SUBROGATION

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

#### § 11.4 PERFORMANCE BOND AND PAYMENT BOND

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

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



## **ARTICLE 12 UNCOVERING AND CORRECTION OF WORK**

### **§ 12.1 UNCOVERING OF WORK**

**§ 12.1.1** If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

**§ 12.1.2** If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

### **§ 12.2 CORRECTION OF WORK**

#### **§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION**

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

#### **§ 12.2.2 AFTER SUBSTANTIAL COMPLETION**

**§ 12.2.2.1** In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

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

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

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

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

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

### § 12.3 ACCEPTANCE OF NONCONFORMING WORK

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

## ARTICLE 13 MISCELLANEOUS PROVISIONS

### § 13.1 GOVERNING LAW

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

### § 13.2 SUCCESSORS AND ASSIGNS

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

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

### § 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

### § 13.4 RIGHTS AND REMEDIES

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

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

### § 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by

such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

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

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

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

### § 13.6 INTEREST

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

### § 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

## ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

### § 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

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

## § 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

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

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

## § 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

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

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

## § 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

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

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

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

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

## **ARTICLE 15 CLAIMS AND DISPUTES**

### **§ 15.1 CLAIMS**

#### **§ 15.1.1 DEFINITION**

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

#### **§ 15.1.2 NOTICE OF CLAIMS**

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

#### **§ 15.1.3 CONTINUING CONTRACT PERFORMANCE**

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

#### **§ 15.1.4 CLAIMS FOR ADDITIONAL COST**

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

#### **§ 15.1.5 CLAIMS FOR ADDITIONAL TIME**

**§ 15.1.5.1** If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

**§ 15.1.5.2** If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

#### **§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES**

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

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

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

### **§ 15.2 INITIAL DECISION**

**§ 15.2.1** Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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

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

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

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

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

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

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

### § 15.3 MEDIATION

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

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

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

#### § 15.4 ARBITRATION

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

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

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

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

#### § 15.4.4 CONSOLIDATION OR JOINDER

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

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

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

**INFORMATION AVAILABLE TO BIDDERS -  
NAVAJO NATION BUSINESS PREFERENCE LAW**

**GENERAL**

**DOCUMENT INCLUDES**

- A. Information provided to the Bidder to aid in his/her understanding of the nature and scope of the project.

**DESCRIPTION**

- A. The Bidding requirements of the project require that preference in contracting, subcontracting, and labor be granted in accordance with tribal law. The attached *Navajo Nation Business Preference Law* (the "Law") presents the particular preference provisions enacted by the Navajo Nation, and which are applicable to this project.
- B. The copy presented here is complete, accurate, and current to the best of the Owner's knowledge, information, and belief. The Owner makes no representations as to the completeness, current edition, or other characteristic of the Law. Neither the Owner nor the Architect will interpret the Law.
- C. The Bidder shall form his/her own conclusions regarding the information presented, and as required elsewhere in the Bidding Documents. Neither the Owner nor the Architect/Engineer accept any responsibility for the conclusions which the Bidder may form.
- D. The Bidder shall be responsible for familiarizing himself/herself with the Navajo Nation Business Preference Law. Documents pertaining to this law can be obtained from the Navajo Nation Business Regulatory Office, Window Rock, Arizona.

**END OF DOCUMENT**

Information Available to Bidders-  
Navajo Nation Business Preference Law



**NAVAJO NATION BUSINESS OPPORTUNITY SOURCE LIST  
OF CERTIFIED NAVAJO-OWNED BUSINESSES**

**GENERAL**

**DOCUMENT INCLUDES**

- A. Information provided to the Bidder to aid in his understanding of the nature and scope of the project.

**DESCRIPTION**

- A. The Navajo Nation Business Opportunity Source List is updated on a monthly basis, pursuant to Navajo Nation Council Resolution CAP-37-02 and the Navajo Nation Business Opportunity Act, Title 5, CH. 2 – Section 201 – 215. This Source List provides a listing of Persons, Firms, Enterprises, Organizations, and/or Other entities currently certified by the Business Regulatory Department as prioritized under Section 204 (A) (1) and (2) of the revised [Navajo Nation Business Opportunity] Act.
- B. The Bidder shall be responsible for familiarizing himself with the Navajo Nation Business Opportunity Source List. Documents pertaining to this law can be obtained from the Navajo Nation Division of Economic Development, Window Rock, Arizona: Business Regulatory Department, P.O. Box 663, Window Rock, Arizona, 86515, telephone: (928) 871-6287, OR via the internet at:

[http://www.navajobusiness.com/pdf/SourceList/Source\\_List.pdf](http://www.navajobusiness.com/pdf/SourceList/Source_List.pdf)

**END OF DOCUMENT**

## **NAVAJO PREFERENCE IN EMPLOYMENT ACT REQUIREMENTS**

- A. Contractors and subcontractors shall comply with the substantive and procedural requirements of the Navajo Preference in Employment Act ("Act") 15 Navajo Tribal Code §601 et. seq., which includes but is not limited to giving preference in employment to members of the Navajo Nation (the term "employment" includes, but is not limited to the recruitment, hiring, promotion, transfer, training, upgrading, reduction-in-force, retention, and recall of employees). Specific requirements are incorporated into the Contract Documents as indicated in the Summary of Specific Requirements below
- B. All information regarding compliance with the Act shall be obtained from:
- Mr. Reynold R. Lee, Director  
Office of Navajo Labor Relations  
P.O. Box 1943  
Window Rock, Navajo Nation, Arizona, 86515  
Phone: (520) 871-6800
- C. SUMMARY OF SPECIFIC REQUIREMENTS of the NAVAJO PREFERENCE IN EMPLOYMENT ACT ("ACT")
1. All employers shall include and specify a Navajo employment preference policy statement in all job announcements and advertisements and employer policies covered by this Act.
  2. All employers shall post in a conspicuous place on its premises for its employees and applicants a Navajo preference policy notice prepared by Office of Navajo Labor Relations (ONLR).
  3. Any seniority system of an employer shall be subject to this Act and all other labor laws of the Navajo Nation. Such a seniority system shall not operate to defeat nor prevent the application of the Act.
  4. The Navajo Nation when contracting with the state government or one of its entities shall include provisions for Navajo preference in all places of employment as provided herein.
  5. All employers shall utilize Navajo Nation employment sources and job services for employee recruitment and referrals; provided, however, that employers do not have the foregoing obligations in the event a Navajo is selected for the employment opportunity who is a current employee of the employer.
  6. All employers shall advertise and announce all job vacancies in at least one newspaper and radio station serving the Navajo Nation; provided, however, that employers do not have the foregoing obligations in the event a Navajo is selected for the employment opportunity who is a current employee of the employer.

## NAVAJO NATION SALES TAX LAW

### GENERAL

### DOCUMENT INCLUDES

- A. Information provided to the Bidder to aid in his understanding of the nature and scope of the project.

### DESCRIPTION

- A. The Bidder shall be responsible for familiarizing himself with the Navajo Nation Sales Tax Law. Documents pertaining to this law can be obtained from the Navajo Nation Office of the Tax Commission:

Contact Person: Larieta L. Tso, Senior Tax Compliance Officer

Physical Address: Office of the Navajo Tax Commission  
HWY 264, 100 Taylor Road  
Karigan Professional Building, Suite 115  
St. Michaels, Arizona 86511

Postal Address: Office of the Navajo Tax Commission  
Post Office Box 1903  
Window Rock, Arizona 86515-1903

Telephone/Email: Telephone # (928) 871-6681  
FAX # (928) 871-7608  
Email: [nnontc@navajotax.org](mailto:nnontc@navajotax.org)

Website Address: <http://www.navajotax.org>

Questions and/or Comments can be emailed to Raquel Billy, Senior Information Systems Technician: [rbilly@navajotax.org](mailto:rbilly@navajotax.org)

**END OF DOCUMENT**

7. All employers shall use non-discriminatory job qualification and selection criteria in employment.
8. All employers shall not penalize, discipline, discharge nor take any adverse action against any Navajo employee without just cause. A written notification to the employee citing such cause for any of the above actions is required in all cases.
9. All employers shall maintain a safe and clean working environment and provide employment conditions which are free of prejudice, intimidation and harassment.
10. Training shall be an integral part of the specific affirmative action plans or activities for Navajo preference in employment.
11. All employers shall establish written necessary qualifications for each employment position in their work force, a copy of which shall be provided to applicants or candidates at the time they express an interest in such position.
12. All employers doing business or engaged in any project or enterprise within the territorial jurisdiction of the Navajo Nation or pursuant to a contract with the Nation shall submit employment information and reports as required to ONLR. Such reports, in form acceptable to ONLR, shall include all information necessary and appropriate to determine compliance with the provisions of this Act.

**END OF NAVAJO PREFERENCE IN EMPLOYMENT ACT REQUIREMENTS**

## NAVAJO NATION SOLID WASTE CODE

### GENERAL

#### DOCUMENT INCLUDES

- A. Information provided to the Bidder to aid in his understanding of the nature and scope of the project.

#### DESCRIPTION

- A. Section 101: Declaration of Purpose: Assertion of Authority  
In order to protect the health, safety, welfare, and environment; to manage, protect, and preserve the resources of the Navajo Nation; to maintain the aesthetic appearance of the Navajo Nation and to provide for the exercise of the inherent sovereign powers of self-government by the Navajo Nation, the Navajo Nation hereby asserts its sovereign authority over all actions taken by all persons within the territorial jurisdiction of the Navajo Nation which affect the generation, collection, transportation, storage and disposal of solid waste.
  
- B. Section 102: Interpretation and Application of the Code:  
This code shall be liberally construed and applied to ensure its purpose as expressed in Section 101. Upon the effective date of this Code, it shall be unlawful for any person within the territorial jurisdiction of the Navajo Nation as defined in 7 N.T.C. Subsection 254, to impound, divert, withdraw, otherwise make any use of or take any action affecting the use of land for solid waste unless the applicable provisions of this Code and its regulations have been complied with. No rights or privileges shall be recognized to generate, collect, transport, store and/or dispose of solid waste other than those accorded under this Code.
  
- C. The Contractor shall be responsible for familiarizing himself with the Navajo Nation Solid Waste Code. Documents pertaining to this law can be obtained from the Navajo Nation Division of Natural Resources:

<u>Primary Contact:</u>	Executive Director
<u>Mailing Address:</u>	Division of Natural Resources NAVAJO NATION P.O. Box 9000 Window Rock, Arizona 86515-9000
<u>Telephone/Fax:</u>	Telephone: (928) 871-6592 / 6593 Facsimile (928) 871-7040
<u>Website Address:</u>	<a href="http://www.dnr.navajo.org/">http://www.dnr.navajo.org/</a>

Questions and/or Comments can be emailed to:  
[elouisewatchman@frontiernet.net](mailto:elouisewatchman@frontiernet.net)

**END OF DOCUMENT**

## **NAVAJO NATION OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)**

### **GENERAL**

#### **DOCUMENT INCLUDES**

- A. Information provided to the Bidder to aid in his understanding of the nature and scope of the project.
  
- B. The Navajo OSHA Program is an enforcement agency of the Navajo Nation that works to promote and enforce the Navajo Nation Occupational Safety & Health Act of 2000 and the applicable codes to assure every working person, across the Navajo Nation, has safe and healthy working conditions.

#### **DESCRIPTION**

- A. The Contractor shall be responsible for familiarizing himself with the Navajo Nation Occupational Safety and Health Act. Documents pertaining to this law can be obtained from the administrative offices as noted herein:

Austin Yazzie, Program Supervisor  
Occupational Safety and Health Administration  
NAVAJO NATION  
P.O. Box 1447  
Window Rock, Arizona 86515-9000  
Phone # (928) 871-6742  
Fax # (928) 871-6825

Website Address: <http://nnosha.org/>

**END OF DOCUMENT**



The Navajo Nation  
Yideeskáądi Nitsáhákees

DR. BUU NYGREN **PRESIDENT**  
RICHELLE MONTOYA **VICE PRESIDENT**

November 2, 2023

AD24-070

Dyron V. Murphy, President  
**DYRON MURPHY ARCHITECTS, P.C.**  
4505 Montbel Place NE  
Albuquerque, New Mexico 87107

**RE: SHIPROCK PINNACLE HOTEL & RESTAURANT**

Dear Mr. Murphy:

The Office of Navajo Labor Relations (ONLR) received your request for prevailing wage rates for the above reference project. Please find attached the ONLR wage rates which are applicable to the building construction project for the Shiprock Pinnacle Hotel & Restaurant.

**Pursuant to the NPEA Section 607(B)(1) "...In all cases where construction is contemplated for which prevailing wage rates have not been set, the contract letting entity shall submit to ONLR a written request for a project prevailing wage scale. Such request shall be submitted not less than 60 days prior to the scheduled date for bid solicitation and shall include detailed information on the anticipated construction classifications, nature' of the project and completion plans...."**

The ONLR respectfully requests that Dyron Murphy Architects, P.C. to review the requirements of the Navajo Preference in Employment Act (NPEA) before any work begins. If a Pre-Construction Conference is scheduled, the ONLR Office at (928) 871-6800 is to be notified and a representative will explain the applicable laws to the general contractor and subcontractors, where necessary.

Should you have any questions, contact our office at (928) 871-6800. Thank You.

Sincerely,

Michael Armijo, CEA  
OFFICE OF NAVAJO LABOR RELATIONS

CONCURRENCE:

Ronald M. Curtis, Program Manager I

ATTACHMENTS



# OFFICE OF NAVAJO LABOR RELATIONS PREVAILING WAGE

Wage Decision: ONLR23-0656B

Date Issued: November 2, 2023

## BUILDING CONSTRUCTION

**Building Construction** includes the construction, demolition, rehabilitation, and repairs of sheltered enclosures with walk-in access for the purpose of housing persons, machinery, equipment, or supplies.

### SHIPROCK PRINNACLE HOTEL & RESTAURANT DYRON MURPHY ARCHITECTS, P.C.

Effective January 1, 2023

<b>Trade Classifications:</b>	<b>Hourly Rate:</b>
Asbestos Worker	\$ 25.57
Brick Layer/ Block Layer	\$ 21.66
Boilermaker	\$ 28.84
Carpenter	\$ 23.01
Cement Mason/Finisher	\$ 21.19
Drywall Hanger	\$ 20.73
Drywall Finisher/Taper	\$ 20.51
Electrician	\$ 24.89
Glazier	\$ 20.85
Insulator	\$ 22.84
Ironworker	\$ 28.41
Laborer	\$ 18.62
Lather	\$ 22.29
Mechanic	\$ 22.84
Painter	\$ 20.47
Plasterer	\$ 20.45
Plumber/Pipe Fitter	\$ 26.29
Roofer	\$ 20.75
Sheet Metal Worker	\$ 26.35
Soft Floor Layer	\$ 20.45
Sprinkler Fitter	\$ 28.31
Tile Layer/Setter	\$ 20.45



<b>Truck Drivers:</b>	<b>Hourly Rate:</b>
Dump Truck	\$ 21.38
Flatbed Truck	\$ 20.91
Water Truck	\$ 21.01
<b>Equipment Operators:</b>	<b>Hourly Rate:</b>
Backhoe	\$ 24.09
Broom	\$ 23.27
Bulldozer	\$ 24.02
Crane	\$ 24.89
Front End Loader	\$ 22.42
Motor Grader	\$ 22.84
Paver	\$ 22.67
Roller/Compactor	\$ 22.40
Scraper	\$ 24.09
Trencher	\$ 24.09

The rates listed above are required minimum ONLR Prevailing Wage Rates. Contractors may pay rates above these rates. The ONLR Director will add wage rates for unlisted classifications needed for work only after review and approval. Overtime is one and one-half times the basic rate for hours worked over forty hours in one week. Foremen will receive an additional \$6.83 per hour. **Where Federal Funds are involved, the Davis-Bacon rates apply.** Other exceptions may apply in accordance with the *Navajo Preference in Employment Act (NPEA)*, Section 7(E). Apprentices must be enrolled in a recognized apprenticeship program as required by Section 7(A)(6) of the NPEA. The appropriate apprenticeship program as outlined by the NPEA Section 7(E)(7) will govern wage rates for such apprentices. These wages apply only to the **SHIPROCK PINNACLE HOTEL & RESTAURANT** construction project.

APPROVED:

  
 \_\_\_\_\_  
 Ronald M. Curtis, Program Manager I

11/2/23  
 \_\_\_\_\_  
 Date

REVISED 1/1/2023marmijo

**SECTION 01 1000  
SUMMARY**

**PART 1 GENERAL**

**1.01 PROJECT**

- A. Project Name: Shiprock Pinnacle Hotel & Restaurant
- B. Owner's Name: Navajo Nation Hospitality Enterprises.
- C. Architect's Name: Dyron Murphy Architects.
- D. The Project consists of the construction of a new 85 room hotel, restaurant and ballroom in Shiprock, New Mexico.

**1.02 OWNER OCCUPANCY**

- A. Owner intends to occupy the Project upon Substantial Completion.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

**1.03 CONTRACTOR USE OF SITE AND PREMISES**

- A. Construction Operations: Limited to areas noted on Drawings.
  - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
- B. Provide access to and from site as required by law and by Owner:
  - 1. Do not obstruct roadways, sidewalks, or other public ways without permit.
- C. Utility Outages and Shutdown:
  - 1. Prevent accidental disruption of utility services to other facilities.

**1.04 SPECIFICATION SECTIONS APPLICABLE TO EVERY CONTRACT**

- A. Unless otherwise noted, provisions of the sections listed below apply to every contract. Specific items of work listed under individual contract descriptions constitute exceptions.
- B. Section 01 2500 - Substitution Procedures.
- C. Section 01 3000 - Administrative Requirements.
- D. Section 01 4000 - Quality Requirements.
- E. Section 01 4100 - Regulatory Requirements
- F. Section 01 4219 - Reference Standards.
- G. Section 01 6000 - Product Requirements.
- H. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- I. Section 01 7000 - Execution and Closeout Requirements.
- J. Section 01 7800 - Closeout Submittals.

**END OF SECTION**

**SECTION 01 2000  
PRICE AND PAYMENT PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedures for preparation and submittal of applications for progress payments.

**1.02 RELATED REQUIREMENTS**

- A. Section 00 5000 - Contracting Forms and Supplements: Forms to be used.

**1.03 SCHEDULE OF VALUES**

- A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in duplicate within 20 days after date of Owner-Contractor Agreement.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization, bonds and insurance, and other items included in general conditions.
- F. Revise schedule to list approved Change Orders, with each Application For Payment.

**1.04 APPLICATIONS FOR PROGRESS PAYMENTS**

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
  - 1. Item Number.
  - 2. Description of work.
  - 3. Scheduled Values.
  - 4. Previous Applications.
  - 5. Work in Place and Stored Materials under this Application.
  - 6. Authorized Change Orders.
  - 7. Total Completed and Stored to Date of Application.
  - 8. Percentage of Completion.
  - 9. Balance to Finish.
  - 10. Retainage.
- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- I. Submit one electronic and NO hard-copies of each Application for Payment.
- J. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

### **1.05 MODIFICATION PROCEDURES**

- A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
  - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
  - 2. Promptly execute the change.
- C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 15 days.
- D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
- E. Substantiation of Costs: Provide full information required for evaluation.
  - 1. Provide the following data:
    - a. Quantities of products, labor, and equipment.
    - b. Taxes, insurance, and bonds.
    - c. Overhead and profit.
    - d. Justification for any change in Contract Time.
    - e. Credit for deletions from Contract, similarly documented.
- F. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- G. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- H. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- I. Promptly enter changes in Project Record Documents.

### **1.06 APPLICATION FOR FINAL PAYMENT**

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
  - 1. All closeout procedures specified in Section 01 7000.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 2500**  
**SUBSTITUTION PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedural requirements for proposed substitutions.

**1.02 RELATED REQUIREMENTS**

- A. Section 00 4325 - Substitution Request Form - During Procurement: Required form for substitution requests made prior to award of contract (During procurement).
- B. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.
- C. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.
- D. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Restrictions on emissions of indoor substitute products.

**1.03 DEFINITIONS**

**1.04 REFERENCE STANDARDS**

- A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage); Current Edition.
- B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase); Current Edition.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 GENERAL REQUIREMENTS**

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
  - 2. Agrees to provide the same warranty for the substitution as for the specified product.
  - 3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
  - 1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
- D. Limit each request to a single proposed substitution item.

**3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT**

- A. Submittal Time Restrictions:
  - 1. Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.
- B. Submittal Form (before award of contract):

**3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION**

- A. Submittal Form (after award of contract):
  - 1. Submit substitution requests by completing the form attached to this section. See this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

- B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
  - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
  - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
  - 3. Bear the costs engendered by proposed substitution of:
    - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.

### **3.04 RESOLUTION**

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.
  - 1. Architect's decision following review of proposed substitution will be noted on the submitted form.

### **3.05 ACCEPTANCE**

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

### **3.06 CLOSEOUT ACTIVITIES**

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

**END OF SECTION**

**SECTION 01 3000**  
**ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Site mobilization meeting.
- E. Progress meetings.
- F. Construction progress schedule.
- G. Contractor's daily reports.
- H. Progress photographs.
- I. Coordination drawings.
- J. Submittals for review, information, and project closeout.
- K. Number of copies of submittals.
- L. Requests for Interpretation (RFI) procedures.
- M. Submittal procedures.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 6000 - Product Requirements: General product requirements.
- B. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.
- C. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

**1.03 REFERENCE STANDARDS**

- A. AIA G716 - Request for Information; 2004.

**1.04 GENERAL ADMINISTRATIVE REQUIREMENTS**

- A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
  - 1. Requests for Interpretation (RFI).
  - 2. Requests for substitution.
  - 3. Shop drawings, product data, and samples.
  - 4. Test and inspection reports.
  - 5. Design data.
  - 6. Manufacturer's instructions and field reports.
  - 7. Applications for payment and change order requests.
  - 8. Progress schedules.
  - 9. Coordination drawings.
  - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
  - 11. Closeout submittals.

**1.05 PROJECT COORDINATOR**

- A. Project Coordinator: Construction Manager.
- B. During construction, coordinate use of site and facilities through the Project Coordinator.

- C. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- D. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 1000 - Summary.
- E. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- F. Make the following types of submittals to Architect through the Project Coordinator:

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE**

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
  - 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
  - 2. Contractor and Architect are required to use this service.
  - 3. It is Contractor's responsibility to submit documents in allowable format.
  - 4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
  - 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, [www.adobe.com](http://www.adobe.com), or Bluebeam PDF Revu, [www.bluebeam.com](http://www.bluebeam.com)), unless such software capability is provided by the service provider.
  - 6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
  - 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Submittal Service: The selected service is:
- C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
- D. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

**3.02 PRECONSTRUCTION MEETING**

- A. Project Coordinator will schedule a meeting after Notice of Award.
- B. Attendance Required:
  - 1. Owner.
  - 2. Architect.
  - 3. Contractor.
- C. Agenda:
  - 1. Execution of Owner-Contractor Agreement.
  - 2. Submission of executed bonds and insurance certificates.
  - 3. Distribution of Contract Documents.



4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
  5. Designation of personnel representing the parties to Contract, Owner and Architect.
  6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  7. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.03 SITE MOBILIZATION MEETING**

- A. Project Coordinator will schedule meeting at the Project site prior to Contractor occupancy.
- B. Attendance Required:
1. Contractor.
  2. Owner.
  3. Architect.
  4. Contractor's superintendent.
  5. Major subcontractors.
- C. Agenda:
1. Use of premises by Owner and Contractor.
  2. Owner's requirements.
  3. Construction facilities and controls provided by Owner.
  4. Temporary utilities provided by Owner.
  5. Survey and building layout.
  6. Security and housekeeping procedures.
  7. Schedules.
  8. Application for payment procedures.
  9. Procedures for testing.
  10. Procedures for maintaining record documents.
  11. Requirements for start-up of equipment.
  12. Inspection and acceptance of equipment put into service during construction period.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.04 PROGRESS MEETINGS**

- A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.
- B. Attendance Required:
1. Contractor.
  2. Owner.
  3. Architect.
  4. Contractor's superintendent.
  5. Major subcontractors.
- C. Agenda:
1. Review minutes of previous meetings.
  2. Review of work progress.
  3. Field observations, problems, and decisions.
  4. Identification of problems that impede, or will impede, planned progress.
  5. Review of submittals schedule and status of submittals.
  6. Maintenance of progress schedule.
  7. Corrective measures to regain projected schedules.
  8. Planned progress during succeeding work period.
  9. Maintenance of quality and work standards.
  10. Effect of proposed changes on progress schedule and coordination.

11. Other business relating to work.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.05 CONSTRUCTION PROGRESS SCHEDULE**

- A. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
  1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- C. Within 10 days after joint review, submit complete schedule.
- D. Submit updated schedule with each Application for Payment.

### **3.06 DAILY CONSTRUCTION REPORTS**

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.

### **3.07 PROGRESS PHOTOGRAPHS**

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Photography Type: Digital; electronic files.
- C. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.
- D. In addition to periodic, recurring views, take photographs of each of the following events:
- E. Views:
  1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
  2. Consult with Architect for instructions on views required.
  3. Provide factual presentation.
  4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
- F. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
  1. Delivery Medium: Via email.
  2. File Naming: Include project identification, date and time of view, and view identification.
  3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
  4. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

### **3.08 COORDINATION DRAWINGS**

- A. Provide information required by Project Coordinator for preparation of coordination drawings.

### **3.09 REQUESTS FOR INTERPRETATION (RFI)**

- A. Definition: A request seeking one of the following:
  1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
  2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
  - 1. Prepare a separate RFI for each specific item.
    - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
    - b. Do not forward requests which solely require internal coordination between subcontractors.
  - 2. Prepare in a format and with content acceptable to Owner.
  - 3. Prepare using software provided by the Electronic Document Submittal Service.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
- E. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
- F. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
- G. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

### **3.10 SUBMITTAL SCHEDULE**

- A. Submit to Architect for review a schedule for submittals in tabular format.
  - 1. Coordinate with Contractor's construction schedule and schedule of values.
  - 2. Format schedule to allow tracking of status of submittals throughout duration of construction.
  - 3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
  - 4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

### **3.11 SUBMITTALS FOR REVIEW**

- A. When the following are specified in individual sections, submit them for review:
  - 1. Product data.
  - 2. Shop drawings.
  - 3. Samples for selection.
  - 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

### **3.12 SUBMITTALS FOR INFORMATION**

- A. When the following are specified in individual sections, submit them for information:
  - 1. Design data.
  - 2. Certificates.
  - 3. Test reports.

4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

### **3.13 SUBMITTALS FOR PROJECT CLOSEOUT**

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
  1. Project record documents.
  2. Operation and maintenance data.
  3. Warranties.
  4. Bonds.
  5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

### **3.14 NUMBER OF COPIES OF SUBMITTALS**

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
  1. After review, produce duplicates.
  2. Retained samples will not be returned to Contractor unless specifically so stated.

### **3.15 SUBMITTAL PROCEDURES**

- A. General Requirements:
  1. Use a separate transmittal for each item.
- B. Product Data Procedures:
  1. Submit only information required by individual specification sections.
  2. Collect required information into a single submittal.
  3. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
  1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
  2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
  1. Transmit related items together as single package.
  2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

### **3.16 SUBMITTAL REVIEW**

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
- D. Architect's and consultants' actions on items submitted for review:
  1. Authorizing purchasing, fabrication, delivery, and installation:

- a. "Approved", or language with same legal meaning.
  - b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
    - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
  - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
  - 2. Not Authorizing fabrication, delivery, and installation:
- E. Architect's and consultants' actions on items submitted for information:
- 1. Items for which no action was taken:
    - a. "Received" - to notify the Contractor that the submittal has been received for record only.
  - 2. Items for which action was taken:
    - a. "Reviewed" - no further action is required from Contractor.

**END OF SECTION**

**SECTION 01 4000**  
**QUALITY REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Control of installation.
- F. Mock-ups.
- G. Tolerances.
- H. Defect Assessment.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 3000 - Administrative Requirements: Submittal procedures.
- B. Section 01 6000 - Product Requirements: Requirements for material and product quality.

**1.03 REFERENCE STANDARDS**

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2019).
- B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2017.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2022.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2019.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2021.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.
- G. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2021.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
  - 1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of inspector.
    - d. Date and time of sampling or inspection.
    - e. Identification of product and specifications section.
    - f. Location in the Project.
    - g. Type of test/inspection.
    - h. Date of test/inspection.
    - i. Results of test/inspection.
    - j. Compliance with Contract Documents.
    - k. When requested by Architect, provide interpretation of results.

2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
  2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
- G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

#### **1.05 QUALITY ASSURANCE**

- A. Testing Agency Qualifications:
1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
  2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
  3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

#### **1.06 REFERENCES AND STANDARDS**

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

#### **1.07 TESTING AND INSPECTION AGENCIES AND SERVICES**

- A. Contractor shall employ and pay for services of an independent testing agency to perform all specified testing.

- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Employed Agency:
  1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
  2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
  3. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
  4. Laboratory: Authorized to operate in the State in which the Project is located.
  5. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
  6. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 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. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect 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. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

### **3.02 MOCK-UPS**

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Notify Architect and Owner's PM fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- F. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- G. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- H. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
  1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.



2. Make corrections as necessary until Architect's approval is issued.
- I. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- J. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

### **3.03 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. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

### **3.04 TESTING AND INSPECTION**

- A. Testing Agency Duties:
  1. Test samples of mixes submitted by Contractor.
  2. Provide qualified personnel at site. Cooperate with Architect 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 and Contractor of observed irregularities or non-compliance of Work or products.
  6. Perform additional tests and inspections required by Architect.
  7. Submit reports of all tests/inspections specified.
- B. Limits on Testing/Inspection Agency Authority:
  1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  2. Agency may not approve or accept any portion of the Work.
  3. Agency may not assume any duties of Contractor.
  4. Agency has no authority to stop the Work.
- C. Contractor Responsibilities:
  1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
  2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
  3. Provide incidental labor and facilities:
    - a. To provide access to Work to be tested/inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    - c. To facilitate tests/inspections.
    - d. To provide storage and curing of test samples.
  4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
  5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
  6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

### **3.05 DEFECT ASSESSMENT**

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

**END OF SECTION**

**SECTION 01 5000**  
**TEMPORARY FACILITIES AND CONTROLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Field offices.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 5813 - Temporary Project Signage.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

**1.04 TEMPORARY UTILITIES**

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. New permanent facilities may not be used.
- C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

**1.05 TELECOMMUNICATIONS SERVICES**

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
  - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
  - 2. Internet Connections: Minimum of one; DSL modem or faster.
  - 3. Email: Account/address reserved for project use.
  - 4. Facsimile Service: Fax-to-email software on personal computer.

**1.06 TEMPORARY SANITARY FACILITIES**

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

**1.07 BARRIERS**

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

**1.08 FENCING**

- A. Construction: Contractor's option.

### **1.09 EXTERIOR ENCLOSURES**

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

### **1.10 INTERIOR ENCLOSURES**

- A. Provide temporary partitions and ceilings as indicated 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.
- B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

### **1.11 SECURITY**

- A. Provide security and facilities to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft.

### **1.12 VEHICULAR ACCESS AND PARKING - SEE SECTION 01 5500**

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

### **1.13 WASTE REMOVAL**

- A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

### **1.14 PROJECT SIGNS - SEE SECTION 01 5813**

### **1.15 FIELD OFFICES**

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 10 persons.
- C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

### **1.16 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.

**PART 2 PRODUCTS - NOT USED**  
**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 5713**  
**TEMPORARY EROSION AND SEDIMENT CONTROL**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Performance bond.
- E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

**1.02 RELATED REQUIREMENTS**

- A. Section 31 1000 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.
- B. Section 31 2200 - Grading: Temporary and permanent grade changes for erosion control.
- C. Section 32 1123 - Aggregate Base Courses: Temporary and permanent roadways.

**1.03 REFERENCE STANDARDS**

- A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus; 2021.
- B. ASTM D4491/D4491M - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 2021.
- C. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2015.
- D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.
- E. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile; 2021a.
- F. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2017 (Reapproved 2021).
- G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.
- H. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control; 1995.
- I. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service; 2015.

**1.04 PERFORMANCE REQUIREMENTS**

- A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP), whether the project is required by law to comply or not.
- B. Also comply with all more stringent requirements of State of New Mexico Erosion and Sedimentation Control Manual.
- C. Comply with all requirements of the Navajo Tribe for erosion and sedimentation control.
- D. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.
- E. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
  - 1. Obtain and pay for permits and provide security required by authority having jurisdiction.

2. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.
- F. Provide to Owner a Performance Bond covering erosion and sedimentation preventive measures only, in an amount equal to 100 percent of the cost of erosion and sedimentation control work.
  - G. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
  - H. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
    1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
    2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.
  - I. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
    1. Control movement of sediment and soil from temporary stockpiles of soil.
    2. Prevent development of ruts due to equipment and vehicular traffic.
    3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
  - J. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
    1. Prevent windblown soil from leaving the project site.
    2. Prevent tracking of mud onto public roads outside site.
    3. Prevent mud and sediment from flowing onto sidewalks and pavements.
    4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
  - K. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
    1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
    2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
  - L. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
    1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
  - M. Open Water: Prevent standing water that could become stagnant.
  - N. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Erosion and Sedimentation Control Plan:
  1. Submit not less than 30 days prior to anticipated start of clearing, grading, or other work involving disturbance of ground surface cover.
  2. Include:

- a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
  - b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
  - c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
  - d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
  - e. Other information required by law.
  - f. Format required by law is acceptable, provided any additional information specified is also included.
3. Obtain the approval of the Plan by authorities having jurisdiction.
  4. Obtain the approval of the Plan by Owner.
- C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.
- D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.
- E. Maintenance Instructions: Provide instructions covering inspection and maintenance for temporary measures that must remain after Substantial Completion.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Mulch: Use one of the following:
1. Straw.
  2. Wood waste, chips, or bark.
  3. Erosion control matting or netting.
  4. Cutback asphalt.
  5. Polyethylene film, where specifically indicated only.
- B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.
- C. Bales: Air dry, rectangular straw bales.
1. Cross Section: 14 by 18 inches (350 by 450 mm), minimum.
  2. Bindings: Wire or string, around long dimension.
- D. Bale Stakes: One of the following, minimum 3 feet (1 m) long:
1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot (1.98 kg per linear m).
  2. Wood, 2 by 2 inches (50 by 50 mm) in cross section.
- E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
1. Average Opening Size: 30 U.S. Std. Sieve (0.600 mm), maximum, when tested in accordance with ASTM D4751.
  2. Permittivity:  $0.05 \text{ sec}^{-1}$ , minimum, when tested in accordance with ASTM D4491/D4491M.
  3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
  4. Tensile Strength: 100 pounds-force (450 N), minimum, in cross-machine direction; 124 pounds-force (550 N), minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
  5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.



- 6. Tear Strength: 55 pounds-force (245 N), minimum, when tested in accordance with ASTM D4533/D4533M.
- 7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
- F. Silt Fence Posts: One of the following, minimum 5 feet (1500 mm) long:
  - 1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot (1.98 kg per linear m).
  - 2. Softwood, 4 by 4 inches (100 by 100 mm) in cross section.
  - 3. Hardwood, 2 by 2 inches (50 by 50 mm) in cross section.
- G. Gravel: See Section 32 1123 for aggregate.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

### **3.02 PREPARATION**

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

### **3.03 SCOPE OF PREVENTIVE MEASURES**

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Construction Entrances: Traffic-bearing aggregate surface.
  - 1. Width: As required; 20 feet (7 m), minimum.
  - 2. Length: 50 feet (16 m), minimum.
  - 3. Provide at each construction entrance from public right-of-way.
  - 4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
- C. Linear Sediment Barriers: Made of silt fences.
  - 1. Provide linear sediment barriers:
    - a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
    - b. Along the top of the slope or top bank of drainage channels and swales that traverse disturbed areas.
    - c. Along the toe of cut slopes and fill slopes.
    - d. Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space at maximum of 200 feet apart (at maximum of 60 m apart).
    - e. Across the entrances to culverts that receive runoff from disturbed areas.
  - 2. Space sediment barriers with the following maximum slope length upslope from barrier:
    - a. Slope of Less Than 2 Percent: 100 feet (30 m)..
    - b. Slope Between 2 and 5 Percent: 75 feet (23 m).
    - c. Slope Between 5 and 10 Percent: 50 feet (15 m).
    - d. Slope Between 10 and 20 Percent: 25 feet (7.5 m).
    - e. Slope Over 20 Percent: 15 feet (4.5 m).
- D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
  - 1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
  - 2. Straw bale row blocking entire inlet face area; anchor into pavement.
- E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
- F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.
- G. Soil Stockpiles: Protect using one of the following measures:

1. Cover with polyethylene film, secured by placing soil on outer edges.
  2. Cover with mulch at least 4 inches (100 mm) thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches (150 mm) of straw or hay.
- H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.
  2. Asphalt: Use only where no traffic, either vehicular or pedestrian, is anticipated.
- I. Temporary Seeding: Use where temporary vegetated cover is required.

### 3.04 INSTALLATION

- A. Traffic-Bearing Aggregate Surface:
1. Excavate minimum of 6 inches (150 mm).
  2. Place geotextile fabric full width and length, with minimum 12 inch (300 mm) overlap at joints.
  3. Place and compact at least 6 inches (150 mm) of 1 1/2 to 3 1/2 inch (40 to 90 mm) diameter stone.
- B. Silt Fences:
1. Store and handle fabric in accordance with ASTM D4873/D4873M.
  2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch (405 mm) high barriers with minimum 36 inch (905 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 4 inches (100 mm) in ground.
  3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch (710 mm) high barriers, minimum 48 inch (1220 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
  4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet (6 m), use nominal 32 inch (810 mm) high barriers with woven wire reinforcement and steel posts spaced at 4 feet (1220 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
  5. Install with top of fabric at nominal height and embedment as specified.
  6. Embed bottom of fabric in a trench on the upslope side of fence, with 2 inches (50 mm) of fabric laid flat on bottom of trench facing upslope; backfill trench and compact.
  7. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches (460 mm), with extra post.
  8. Fasten fabric to wood posts using one of the following:
    - a. Four nails per post with 3/4 inch (19 mm) diameter flat or button head, 1 inch (25 mm) long, and 14 gauge, 0.083 inch (2.11 mm) shank diameter.
    - b. Five staples per post with at least 17 gauge, 0.0453 inch (1.150 mm) wire, 3/4 inch (19 mm) crown width and 1/2 inch (12 mm) long legs.
  9. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
  10. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches (300 mm) high with post spacing not more than 4 feet (1220 mm).
- C. Straw Bale Rows:
1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
  2. Install bales so that bindings are not in contact with the ground.
  3. Embed bales at least 4 inches (100 mm) in the ground.
  4. Anchor bales with at least two stakes per bale, driven at least 18 inches (450 mm) into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
  5. Fill gaps between ends of bales with loose straw wedged tightly.
  6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

- D. Mulching Over Large Areas:
  1. Dry Straw and Hay: Apply 2-1/2 tons per acre (6350 kg per hectare); anchor using dull disc harrow or emulsified asphalt applied using same spraying machine at 100 gallons of water per ton of mulch.
  2. Wood Waste: Apply 6 to 9 tons per acre (15,200 to 20,800 kg per hectare).
  3. Asphalt: Apply at 1200 gallons per acre (11,000 L per hectare).
  4. Erosion Control Matting: Comply with manufacturer's instructions.
- E. Mulching Over Small and Medium Areas:
  1. Dry Straw and Hay: Apply 4 to 6 inches (100 to 150 mm) depth.
  2. Wood Waste: Apply 2 to 3 inches (50 to 75 mm) depth.
  3. Asphalt: Apply 1/4 gallon per square yard (1 L per 100 sq m).
  4. Erosion Control Matting: Comply with manufacturer's instructions.
- F. Temporary Seeding:
  1. When hydraulic seeder is used, seedbed preparation is not required.
  2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
  3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft (0.5 kg per 100 sq m).
  4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft (6 to 8 kg per 100 sq m).
  5. Incorporate fertilizer into soil before seeding.
  6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch (12 to 25 mm) deep.
  7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
  8. Repeat irrigation as required until grass is established.

### **3.05 MAINTENANCE**

- A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches (13 mm) or more rainfall at the project site, and daily during prolonged rainfall.
- B. Repair deficiencies immediately.
- C. Silt Fences:
  1. Promptly replace fabric that deteriorates unless need for fence has passed.
  2. Remove silt deposits that exceed one-third of the height of the fence.
  3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- D. Straw Bale Rows:
  1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
  2. Remove silt deposits that exceed one-half of the height of the bales.
  3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- E. Clean out temporary sediment control structures weekly and relocate soil on site.
- F. Place sediment in appropriate locations on site; do not remove from site.

### **3.06 CLEAN UP**

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

**END OF SECTION**



**SECTION 01 5813**  
**TEMPORARY PROJECT SIGNAGE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Project identification sign.
- B. Project informational signs.

**1.02 REFERENCE STANDARDS**

- A. FHWA (SHS) - Standard Highway Signs and Markings; 2004, with Supplement (2012).

**1.03 QUALITY ASSURANCE**

- A. Design sign and structure to withstand 50 miles/hr (80 km/hr) wind velocity.
- B. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.

**PART 2 PRODUCTS**

**2.01 SIGN MATERIALS**

- A. Structure and Framing: New, wood, structurally adequate.
- B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch (19 mm) thick, standard large sizes to minimize joints.
- C. Paint and Primers: Exterior quality, two coats; sign background of TBD color.
- D. Lettering: Exterior quality paint, contrasting colors.

**2.02 PROJECT IDENTIFICATION SIGN**

- A. One painted sign of construction, design, and content indicated on drawings, location designated.
- B. Content:
  - 1. Project number, title, logo and name of Owner as indicated on Contract Documents.
  - 2. Names and titles of authorities.
  - 3. Names and titles of Architect and Consultants.
  - 4. Name of Prime Contractor and major Subcontractors.

**2.03 PROJECT INFORMATIONAL SIGNS**

- A. Painted informational signs of same colors and lettering as Project Identification sign, or standard products; size lettering to provide legibility at 100 foot (30 m) distance.
- B. Provide at each field office, storage shed, and directional signs to direct traffic into and within site. Relocate as Work progress requires.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Install project identification sign within 30 days after date fixed by Notice to Proceed.
- B. Erect at designated location.
- C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
- D. Install sign surface plumb and level, with butt joints. Anchor securely.

### **3.02 MAINTENANCE**

- A. Maintain signs and supports clean, repair deterioration and damage.

### **3.03 REMOVAL**

- A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

**END OF SECTION**

**SECTION 01 6000**  
**PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary: Identification of Owner-supplied products.
- B. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- C. Section 01 4000 - Quality Requirements: Product quality monitoring.
- D. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- E. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

**1.03 REFERENCE STANDARDS**

- A. ISO 14025 - Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures; 2006.
- B. ISO 14040 - Environmental Management - Life Cycle Assessment - Principles and Framework; 2006, with Amendment (2020).
- C. ISO 14044 - Environmental Management - Life Cycle Assessment - Requirements and Guidelines; 2006, with Amendment (2020).
- D. ISO 21930 - Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services; 2017.
- E. NSF 332 - Sustainability Assessment for Resilient Floor Coverings; 2015.

**1.04 SUBMITTALS**

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

**1.05 QUALITY ASSURANCE**

**PART 2 PRODUCTS**

**2.01 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. See Section 01 4000 - Quality Requirements, for additional source quality control requirements.

- C. Use of products having any of the following characteristics is not permitted:
- D. Where other criteria are met, Contractor shall give preference to products that:
  - 1. If used on interior, have lower emissions, as defined in Section 01 6116.
  - 2. If wet-applied, have lower VOC content, as defined in Section 01 6116.

## **2.02 PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

## **2.03 MAINTENANCE MATERIALS**

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

## **PART 3 EXECUTION**

### **3.01 SUBSTITUTION LIMITATIONS**

- A. See Section 01 2500 - Substitution Procedures.

### **3.02 OWNER-SUPPLIED PRODUCTS**

- A. Owner's Responsibilities:
  - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
  - 2. Arrange and pay for product delivery to site.
  - 3. On delivery, inspect products jointly with Contractor.
  - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
  - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
  - 1. Review Owner reviewed shop drawings, product data, and samples.
  - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
  - 3. Handle, store, install and finish products.
  - 4. Repair or replace items damaged after receipt.

### **3.03 TRANSPORTATION AND HANDLING**

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.



H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### **3.04 STORAGE AND PROTECTION**

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION**

**SECTION 01 6116**  
**VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.
- C. Requirement for installer certification that they did not use any non-compliant products.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 3000 - Administrative Requirements: Submittal procedures.
- B. Section 01 4000 - Quality Requirements: Procedures for testing and certifications.
- C. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- D. Section 07 9200 - Joint Sealants: Emissions-compliant sealants.

**1.03 DEFINITIONS**

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
  - 1. Interior paints and coatings applied on site.
  - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
  - 3. Thermal and acoustical insulation.
  - 4. Free-standing furniture.
  - 5. Exterior applied products (for Healthcare and Schools projects only).
  - 6. Other products when specifically stated in the specifications.
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
  - 1. Interior paints and coatings applied on site.
  - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
  - 3. Wet-applied roofing and waterproofing.
  - 4. Other products when specifically stated in the specifications.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
  - 1. Stone.
  - 2. Concrete.
  - 3. Metals that are plated, anodized, or powder-coated.
  - 4. Glass.
  - 5. Ceramics.
  - 6. Solid wood flooring that is unfinished and untreated.

**1.04 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2018).

- C. BIFMA e3 - Furniture Sustainability Standard; Business and Institutional Furniture Manufacturers Association; 2019.
- D. BIFMA M7.1 - Standard Test Method for Determining VOC Emissions from Office Furniture Systems, Components, and Seating; 2011 (Reaffirmed 2021).
- E. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- F. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board; current edition.
- G. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.
- H. GreenSeal GS-36 - Standard for Adhesives for Commercial Use; 2013.
- I. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).
- J. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2017).
- K. SCS (CPD) - SCS Certified Products; Current Edition.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
- C. Sustainable Design Reporting: Submit evidence of compliance.
- D. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

#### **1.06 QUALITY ASSURANCE**

- A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
  - 1. Wet-Applied Products: State amount applied in mass per surface area.
  - 2. Paints and Coatings: Test tinted products, not just tinting bases.
  - 3. Product data submittal showing VOC content is NOT acceptable evidence.
  - 4. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
  - 1. Evidence of Compliance: Acceptable types of evidence are:
    - a. Report of laboratory testing performed in accordance with requirements.
    - b. Published product data showing compliance with requirements.
    - c. Certification by manufacturer that product complies with requirements.
- C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
  - 1. Evidence of Compliance: Acceptable types of evidence are:
    - a. Current SCS "No Added Formaldehyde (NAF)" certification; [www.scs-certified.com](http://www.scs-certified.com).
    - b. Report of laboratory testing performed in accordance with requirements.
    - c. Published product data showing compliance with requirements.
    - d. Certification by manufacturer that product complies with requirements.
- D. Furnishings Emissions Standard and Test Method: BIFMA e3 Sections 7.6.1 and 7.6.2, tested in accordance with BIFMA M7.1.
  - 1. Evidence of Compliance:

- a. Test report showing compliance and stating exposure scenario used.
- E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
  - 1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
  - 2. Furnishings: Comply with Furnishings Emissions Standard and Test Method.
  - 3. Inherently Non-Emitting Materials.
- C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
  - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
  - 2. Aerosol Adhesives: GreenSeal GS-36.
  - 3. Joint Sealants: SCAQMD 1168 Rule.
  - 4. Paints and Coatings: Each color; most stringent of the following:
    - a. 40 CFR 59, Subpart D.
    - b. SCAQMD 1113 Rule.
    - c. CARB (SCM).
  - 5. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

## **PART 3 EXECUTION**

### **3.01 FIELD QUALITY CONTROL**

- A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

**END OF SECTION**

**SECTION 01 7000**  
**EXECUTION AND CLOSEOUT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Pre-installation meetings.
- C. Cutting and patching.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- H. General requirements for maintenance service.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
- C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- E. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- F. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

**1.03 REFERENCE STANDARDS**

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
  - 1. On request, submit documentation verifying accuracy of survey work.
  - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
  - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather exposed or moisture resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight exposed elements.
  - 5. Work of Owner or separate Contractor.

**1.05 QUALIFICATIONS**

- A. For surveying work, employ a land surveyor registered in New Mexico and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

- B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in New Mexico. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

#### **1.06 PROJECT CONDITIONS**

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
  1. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- H. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

#### **1.07 COORDINATION**

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated 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.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. 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.

### **PART 2 PRODUCTS**

#### **2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that 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. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

#### **3.02 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 any new material or substance in contact or bond.

#### **3.03 PREINSTALLATION MEETINGS**

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

#### **3.04 LAYING OUT THE WORK**

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
  - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.

2. Grid or axis for structures.
  3. Building foundation, column locations, ground floor elevations.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

### **3.05 GENERAL INSTALLATION REQUIREMENTS**

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

### **3.06 CUTTING AND PATCHING**

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
  1. Complete the work.
  2. Fit products together to integrate with other work.
  3. Provide openings for penetration of mechanical, electrical, and other services.
  4. Match work that has been cut to adjacent work.
  5. Repair areas adjacent to cuts to required condition.
  6. Repair new work damaged by subsequent work.
  7. Remove samples of installed work for testing when requested.
  8. Remove and replace defective and non-complying work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.
- I. Patching:
  1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
  2. Match color, texture, and appearance.
  3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

### **3.07 PROGRESS CLEANING**

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a 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 the space.



- 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 trash/rubbish from site periodically and dispose off-site; do not burn or bury.

### **3.08 PROTECTION OF INSTALLED WORK**

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

### **3.09 SYSTEM STARTUP**

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

### **3.10 ADJUSTING**

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

### **3.11 FINAL CLEANING**

- A. Use cleaning materials that are nonhazardous.
- 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. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### **3.12 CLOSEOUT PROCEDURES**

- A. Make submittals that are required by governing or other authorities.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

### **3.13 MAINTENANCE**

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

**END OF SECTION**

## SECTION 01 7419

### CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

#### PART 1 GENERAL

##### 1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- B. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- C. Develop and follow a Waste Management Plan designed to implement these requirements.
- D. Methods of trash/waste disposal that are not acceptable are:
  - 1. Burning on the project site.
  - 2. Burying on the project site.
  - 3. Dumping or burying on other property, public or private.
  - 4. Other illegal dumping or burying.
  - 5. Incineration, either on- or off-site.
- E. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

##### 1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: List of items to be salvaged from the existing building for relocation in project or for Owner.
- B. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- C. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- D. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- E. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.
- F. Section 31 2000 - Earthwork: Handling and disposal of land clearing debris.

##### 1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Waste Management Plan: Include the following information:
  1. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
  2. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
  3. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
  4. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
  5. Off-site dumping at non-approved facilities or vacant land is strictly prohibited.

#### **PART 2 PRODUCTS - NOT USED**

#### **PART 3 EXECUTION**

##### **3.01 WASTE MANAGEMENT PLAN IMPLEMENTATION**

- A. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- B. Meetings: Discuss trash/waste management goals and issues at project meetings, particularly at:
  1. Preconstruction meeting.
- C. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
  1. As a minimum, provide:
    - a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
  2. Locate enclosures out of the way of construction traffic.
  3. Provide adequate space for pick-up and delivery and convenience to subcontractors.
  4. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

- D. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- E. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- F. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

**END OF SECTION**

**SECTION 01 7800  
CLOSEOUT SUBMITTALS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Project record documents.
- B. Operation and maintenance data.
- C. Materials transparency manual.
- D. Warranties and bonds.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

**1.03 SUBMITTALS**

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
  - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 3. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Materials Transparency Manual:
  - 1. Compile and submit a digital and a printed version of information disclosing materials content for interior finishes, furnishings (including workstations), built-in furniture. Meet IWBI (BS) requirements for format and content.
- D. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 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 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Addenda.
  - 3. Change Orders and other modifications to the Contract.
- 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.

- E. Record Drawings: Legibly mark each item to record actual construction including:
  - 1. Field changes of dimension and detail.
  - 2. Details not on original Contract drawings.

### **3.02 OPERATION AND MAINTENANCE DATA**

- A. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- B. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- C. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### **3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES**

- A. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

### **3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

- A. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

### **3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS**

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

### **3.06 WARRANTIES AND BONDS**

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

**END OF SECTION**



**SECTION 01 7900**  
**DEMONSTRATION AND TRAINING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
  - 1. HVAC systems and equipment.
  - 2. Plumbing equipment.
  - 3. Electrical systems and equipment.
  - 4. Conveying systems.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:
  - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
  - 2. Submit one copy to the Commissioning Authority, not to be returned.
  - 3. Make commissioning submittals on time schedule specified by Commissioning Authority.
  - 4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.
- B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
  - 1. Submit to Commissioning Authority for review and inclusion in overall training plan.
  - 2. Submit not less than four weeks prior to start of training.
  - 3. Revise and resubmit until acceptable.
  - 4. Provide an overall schedule showing all training sessions.
  - 5. Include at least the following for each training session:
    - a. Identification, date, time, and duration.
    - b. Description of products and/or systems to be covered.
    - c. Name of firm and person conducting training; include qualifications.
    - d. Intended audience, such as job description.
    - e. Objectives of training and suggested methods of ensuring adequate training.
    - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
    - g. Media to be used, such a slides, hand-outs, etc.
    - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
  - 1. Include applicable portion of O&M manuals.
  - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
  - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.

**1.04 QUALITY ASSURANCE**

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
  - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.

2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 DEMONSTRATION - GENERAL**

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
  1. Perform demonstrations not less than two weeks prior to Substantial Completion.
  2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
  1. Perform demonstrations not less than two weeks prior to Substantial Completion.

### **3.02 TRAINING - GENERAL**

- A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.
- B. Conduct training on-site unless otherwise indicated.
- C. Owner will provide classroom and seating at no cost to Contractor.
- D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
- E. Provide training in minimum two hour segments.
- F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.
- G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
  1. The location of the O&M manuals and procedures for use and preservation; backup copies.
  2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
  3. Typical uses of the O&M manuals.
- I. Product- and System-Specific Training:
  1. Review the applicable O&M manuals.
  2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
  3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
  4. Provide hands-on training on all operational modes possible and preventive maintenance.
  5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
  6. Discuss common troubleshooting problems and solutions.

7. Discuss any peculiarities of equipment installation or operation.
  8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
  9. Review recommended tools and spare parts inventory suggestions of manufacturers.
  10. Review spare parts and tools required to be furnished by Contractor.
  11. Review spare parts suppliers and sources and procurement procedures.
- J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

**END OF SECTION**

**SECTION 02 4100  
DEMOLITION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Removal of miscellaneous site improvements as required for new construction.
- B. Removal of demolished materials.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- B. Section 01 5713 - Temporary Erosion and Sediment Control.
- L. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.

**1.03 REFERENCE STANDARDS**

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Site Plan: Indicate:
  - 1. Areas for temporary construction and field offices.
  - 2. Areas for temporary and permanent placement of removed materials.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

**1.05 QUALITY ASSURANCE**

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
  - 1. Minimum of 5 years of documented experience.

**PART 2 PRODUCTS -- NOT USED**

**PART 3 EXECUTION**

**3.01 DEMOLITION**

- A. Remove paving and curbs as indicated in drawings.
- B. Remove portions of buildings as indicated in drawings.
- C. Remove fences and gates as indicated in drawings.
- D. Remove other items indicated, for salvage, relocation, recycling, and safe disposal. Refer to Section 01 1000 Summary for salvage items..

**3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with requirements in Section 01 7000.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - 3. Provide, erect, and maintain temporary barriers and security devices.
  - 4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.

5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  6. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
  7. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
  8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
  - D. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
  - E. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.

### **3.03 EXISTING UTILITIES**

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone. Identify and mark, in same manner as other utilities to remain, utilities to be reconnected.

### **3.04 SELECTIVE DEMOLITION FOR ALTERATIONS**

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
  1. Verify construction and utility arrangements are as indicated.
  2. Report discrepancies to Architect before disturbing existing installation.
  3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Remove existing work as indicated and required to accomplish new work.
  1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
  2. Remove items indicated on drawings.
- C. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
  1. Verify that abandoned services serve only abandoned facilities before removal.
  2. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.
- D. Protect existing work to remain.
  1. Prevent movement of structure. Provide shoring and bracing as required.
  2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.

3. Repair adjacent construction and finishes damaged during removal work.
4. Patch to match new work.

**3.05 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Remove materials not to be reused on site; comply with requirements of Section 01 7419 - Waste Management.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION**

**SECTION 03 1000**  
**CONCRETE FORMING AND ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. This section includes formwork for cast-in-place concrete, including water stops, and installation of embedded items.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 20 00 - Concrete Reinforcement
- B. Section 03 30 00 - Cast-In-Place Concrete
- C. Section 07 26 00 - Under-Slab Vapor Retarder

**1.03 REFERENCE STANDARDS**

- A. American Society for Testing and Materials (ASTM); latest version
  - 1. ASTM D226 - Specification for Asphalt - Saturated Organic Felt used in Roofing and Waterproofing
  - 2. ASTM D1751 - Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

**1.04 QUALITY ASSURANCE**

- A. Comply with the American Concrete Institute Standard, ACI 347-04, Recommended Practice for Concrete Formwork.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Forms for Exposed Finish Concrete: Plywood complying with Voluntary Product Standard PS 1-07 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better or metal, metal-framed plywood or other acceptable panel-type materials. Plywood shall be mill-oiled and edge-sealed, with each piece bearing legible inspection trademark. Furnish in largest practicable sizes to minimize number of joints. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- B. Forms for Unexposed Finish Concrete: Use plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Form Coatings: Commercial formulation that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- D. Chamfer Strips: 3/4 inch by 3/4 inch wood, PVC, or rubber.
- E. Preformed Construction Joint: 24-gage steel, galvanized, shaped to form a continuous tongue and groove key.
- F. Preformed Control Joint: Rigid plastic or metal strip with removable top section.
- G. Expansion Joint Material: Asphalt saturated fiberboard, 1/2 inch thick, meeting the requirements of ASTM D 1751.
- H. Felt: Asphalt-saturated organic felt, weighing 30 pounds per 100 square feet, meeting the requirements of ASTM D 226.
- I. Water stops: PVC, meeting the requirements of CRD-C572. Provide 6 inches wide dumbbell shape water stop with 3/16-inch minimum web thickness and 3/8 inch minimum end bulb diameter.
- J. Recycled Content: Minimum 5 percent post-consumer content, or minimum 20 percent pre-consumer recycled content at contractor's option.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel. Set screeds accurately. Embedded items shall be accurately aligned and adequately supported. Verify installation of mechanical, plumbing, and electrical items to be embedded in concrete. Correct any unsatisfactory condition before proceeding further.

### **3.02 PREPARATION**

- A. Form Coating: Coat contact surfaces of forms with a form coating compound before reinforcement is placed. Thin form-coating compounds with thinning agent and apply as specified in manufacturer's instructions. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed.

### **3.03 INSTALLATION**

- A. Formwork: Formwork shall support vertical and lateral loads that are applied until such loads can be supported by concrete structure. Formwork shall be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials. Construct forms to sizes, shapes, lines and dimensions shown. Perform surveys to obtain accurate alignment. Provide for recesses, chamfers, blocking, anchorages, inserts, and other features required in work. Select materials to obtain required finishes. Butt joints solidly and provide backup at joints to prevent leakage of cement paste.
- B. Chamfer Strips: Provide at exposed corners and edges.
- C. Form Ties: Use factory fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.
- D. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

### **3.04 INSTALLATION OF EMBEDDED ITEMS**

- A. General: Set anchorage devices and other embedded items accurately. Use setting drawings, diagrams, templates, and printed instructions provided by supplier. Secure embedded items such that they are not displaced during placement of concrete.
- B. Water stops: Install according to manufacturers printed instructions. Splice water stop sections using square cut butt joints and fuse sections together with indirect heat from preheated splicing iron. Use of direct flame is prohibited.
  - 1. Place water stops in all concrete construction joints in basement walls around the building perimeter that are exposed to soil, weather, or moisture, and in any other construction joints that have the potential to allow water infiltration into the building.

### **3.05 JOINTS**

- A. Construction Joints in Walls, Foundations, and Slabs on Grade: Provide keyways at least 1 ½ inches deep in vertical construction joints in walls and construction joints in slabs on grade and foundations. Discontinue every other horizontal bar through slab on grade construction joints unless noted otherwise.
- B. Preformed Construction Joint for Slabs on Grade: Secure with galvanized steel stakes, 1/8 inch thick by 1-1/8 inches wide with ½ inch deep rib and tapered point. Splice adjoining joints with 24 gauge steel, galvanized splice plates.
- C. Isolation Joints in Slabs on Grade: Construct isolation joints in interior slabs using 30 lb. felt. Provide isolation joints at points of contact between slabs on grade and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated. Construct isolation joints on exterior slabs abutting vertical surfaces with ½ inch thick expansion joint material.



D. Control Joints in Slabs-on-Grade:

1. Preformed Strip: Insert premolded rigid plastic, or metal strip into fresh concrete. Cut groove for strip using 10-foot-long straight edge cutting tool. Depths of strip shall be one fourth of slab thickness. Press strip into groove such that top of strip is level with the concrete surface. Pull off removable top section, if any, prior to troweling.
2. Saw Cut: Contractor may saw cut control joints instead of using preformed strips. Saw cut joints shall be 1/8 inch wide. Saw cut depth should equal 1/4 of slab depth. Cut joints after concrete has hardened sufficiently to prevent raveling; usually 4 to 12 hours after slab has been cast and finished. Use diamond or silicone-carbide blades.

- E. Control Joints in Walls: Create weakened planes in cantilevered retaining walls at 25 feet on center. Use preformed strips, placed vertically, full height in each face of wall. Depth of strips shall be one inch.

**3.06 REMOVAL OF FORMWORK**

- A. General: Prevent excessive deflection, distortion, and damage to concrete when forms are stripped. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
- B. Formwork and supports at sides of concrete shall remain in place for 24 hours after concrete placement. This period represents cumulative number of hours, not necessarily consecutive, during which the temperature of the air surrounding the concrete is above 50 degrees  
F. Formwork and shoring which support the weight of concrete shall not be removed until concrete has attained its specified compressive strength.
- C. Ensure safety of the structure. Do not superimpose any load on concrete until forms are removed, and concrete is cured.

**3.07 RE-USE OF FORMS**

- A. General: Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
- B. When forms are intended for successive concrete placement, thoroughly clean surfaces and remove fins and latence. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces.

**END OF SECTION**

**SECTION 03 2000**  
**CONCRETE REINFORCEMENT**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. This section includes fabrication and installation of deformed bar and welded wire fabric reinforcing steel.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 10 00 - Concrete Forming and Accessories
- B. Section 03 30 00 - Cast In Place Concrete

**1.03 REFERENCE STANDARDS:**

- A. American Concrete Institute (ACI), latest versions:
  - 1. ACI 301 - Specifications for Structural Concrete for Buildings
  - 2. ACI 315 - Details and Detailing of Concrete Reinforcement
  - 3. ACI 318 - Building Code Requirements for Structural Concrete
- B. American Society for Testing and Materials (ASTM), latest versions:
  - 1. ASTM A82/A82M - Standard Specification for Steel Wire, plain, for Concrete Reinforcement
  - 2. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
  - 3. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- C. Concrete Reinforcing Steel Institute (CRSI). Design Handbook, latest version

**1.04 SUBMITTALS**

- A. Shop Drawings: Submit shop drawings for reinforcing steel. Comply with ACI 315 requirements showing layout, bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of reinforcing steel. Shop Drawings shall not be made by reproduction of the Contract Drawings.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Reinforcing Bars: ASTM A 615, Grade 60. Stirrups and ties may be Grade 40.
- B. Welded Wire Fabric: ASTM A 185, flat sheets.
- C. Steel Wire: ASTM A 82, 16 gage.
- D. Supports for Reinforcing Steel: Wire bar type and precast concrete block type meeting the requirements of CRSI Manual of Standard Practice.

**2.02 FABRICATION**

- A. Fabricate reinforcing steel in accordance with fabricating tolerances in ACI 315.
- B. Do not fabricate reinforcing steel until shop drawings are approved.

**PART 3 EXECUTION**

**3.01 PLACING BAR SUPPORTS**

- A. General: Provide bar supports meeting the requirements of CRSI Specification for Placing Bar Supports.
- B. Slabs-on-grade: Use supports with sand plates or precast concrete blocks or horizontal runners where base material will not support chair legs.

### 3.02 PLACING REINFORCING STEEL

- A. General: Comply with CRSI Code of Standard Practice for "Placing Reinforcing Bars".
- B. Clean reinforcing steel of loose rust and mill scale, earth, ice, and other materials, which reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcing steel against displacement by formwork, construction, or concrete placement operations. Place reinforcing steel to obtain minimum coverages. Arrange, space and securely tie bars and bar supports to hold reinforcing steel in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
  - 1. Concrete Cover:

Concrete cast against and permanently exposed to earth or weather	3 inches
Bars larger than No. 5	2 inches
Bars No. 5 or smaller	1 1/2 inches
- D. Rebar Splices: Locate at points of minimum stress or as shown on contract drawings. Unless noted otherwise, provide lap splices 30 bar diameters (18 inches minimum) in length.
- E. Welded Wire Fabric Splices: Lap one complete wire spacing.
- F. Corner Reinforcing: Provide corner bars of same size and spacing as horizontal reinforcing steel. Lap with horizontal reinforcing 30 bar diameters or 18 inches minimum length.
- G. Reinforcing at Construction/Control Joints: Continue reinforcing steel through construction joints unless noted otherwise. Discontinue reinforcing steel 2 inches from preformed construction joints in slabs-on-grade. Cut alternate longitudinal bars at weakened plane control joints in walls.

**END OF SECTION**

**SECTION 03 3000**  
**CAST-IN-PLACE CONCRETE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. This section covers cast-in-place concrete including finishing, surface repair and curing.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 10 00 - Concrete Forming and Accessories
- B. Section 03 20 00 - Concrete Reinforcement
- C. Section 07 26 00 - Under Slab Vapor Retarder

**1.03 REFERENCE STANDARDS**

- A. Meet the requirements of the following codes, specifications, and standards.
  - 1. American Concrete Institute (ACI) Publications, latest versions:
    - a. ACI 301 - Specifications for Structural Concrete for Buildings
    - b. ACI 305.1 - Standard Specification for Hot Weather Concreting
    - c. ACI 306.1 - Standard Specification for Cold Weather Concreting
    - d. ACI 318 - Building Code Requirements for Structural Concrete.
  - 2. ASTM International (ASTM), latest versions:
    - a. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field
    - b. ASTM C33/C33M - Standard Specification for Concrete Aggregates
    - c. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
    - d. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete
    - e. ASTM C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
    - f. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
    - g. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete
    - h. ASTM C150/C150M - Standard Specification for Portland Cement
    - i. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete
    - j. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete
    - k. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
    - l. ASTM C231/C231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
    - m. ASTM C260/C260M - Standard Specification for Air Entraining Admixtures for Concrete
    - n. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
    - o. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete
    - p. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
    - q. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

**1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and admixtures.
- B. Concrete Mix Design:
  - 1. Submit mix design in accordance with ACI-301, Section 4.

2. Submit with mix design results of laboratory tests performed within previous 12 months indicating aggregates from the proposed source comply with the requirements of ASTM C 33 or C 330 as applicable.
  3. Submit the proposed area of use for each mix design submitted (footings, stemwalls, slabs, walls, columns, etc.).
- C. Granular Base Course: Submit gradation, plasticity index, and wear information.
- D. Test Reports: Submit copies of test reports for concrete compressive strength, air content, temperature, and slump. Submit copies of granular base course test reports.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities.
- B. Environmental Requirements: Manufacturer and Contractor shall conform to Federal, State, and Local V.O.C. (Volatile Organic Compound) Regulations in area where Project is located. Notify A/E in writing if variations to Specifications herein are required.
1. V.O.C. content shall be a maximum 250 (55) gm/liter unless more stringent codes or laws apply.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Portland Cement: ASTM C 150, Type I or II, low alkali. Use one brand of cement throughout project.
- B. Normal Weight Aggregates: ASTM C 33. Provide aggregates from a single source for exposed concrete.
- C. Lightweight Aggregates: ASTM C330. Provide aggregates from single source for each class of concrete.
- D. Water: Potable.
- E. Air-Entraining Admixture: ASTM C 260.
- F. Water Reducing Admixture: ASTM C 494.
- G. Fly-Ash: ASTM C 618, Class C and Class F for reactive aggregates.
- H. Moisture-Retaining Cover: Provide waterproof paper, polyethylene film, or polyethylene-coated burlap meeting the requirements of ASTM C 171.
- I. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound meeting the requirements of ASTM C 309; Type 1-D with fugitive dye for interior concrete and foundations; Type 2, white pigmented, for exposed exterior concrete except exposed exterior Architectural concrete, use Type 1-D.
- Curing compound shall NOT be used on interior slabs, except exposed integrally colored concrete slabs. Curing compound to be used on integrally colored concrete slabs shall be approved by the manufacturer of the color.
- J. Vapor Retarder shall comply with Section 07 26 00 of these Specifications.
- K. Granular base shall meet the following grading requirements when tested in accordance with ASTM C 136.
- Granular base shall meet the gradation and material properties requirements as listed in the General Structural Notes.
- The plasticity Index shall be no greater than 3 when tested in accordance with ASTM D 4318. The coarse aggregate shall have a percent wear of 50 or less when tested in accordance with ASTM C 131

## **2.02 PROPORTIONING AND DESIGN OF MIXES**

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial mixture or field experience methods as specified in ACI 301, Section 4. If trial mixture method is used, employ an independent testing facility, acceptable to Architect, for preparing and reporting proposed mix designs.
- B. Submit written reports to Architect, or 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 approved.
- C. Refer to the General Structural Notes for concrete strengths.
- D. Slabs-on-ground or on vapor retarder shall have a water/total cementitious ratio not to exceed 0.45.
- E. Admixtures
  - 1. Use water reducing admixture conforming to ASTM C 494, Type A, in all concrete unless approved otherwise by the Structural Engineer.
  - 2. All other admixtures shall have the written approval of the Architect or Structural Engineer.
  - 3. Calcium chloride is not permitted.
  - 4. All admixtures, except high range water reducers, shall be added to the concrete at the batch plant.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel. Set screeds accurately. Embedded items shall be accurately aligned and adequately supported. Verify installation of mechanical, plumbing, and electrical items to be embedded in concrete. Correct any unsatisfactory condition before proceeding further.

### **3.02 PREPARATION**

- A. Before placing concrete, clean and roughen surface of previously placed concrete. Clean reinforcing steel. Remove debris, providing clean-outs at bottom of forms when necessary. Moisten surfaces to receive concrete unless otherwise prepared. Remove excess water before placing concrete.

### **3.03 CONCRETE PLACEMENT**

- A. General: Comply with ACI 301.
- B. Place concrete continuously in layers not deeper than 24 inches. Concrete shall not be placed against concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints. Deposit concrete as nearly as practicable to its final location to avoid segregation. Do not use vibrators to transport concrete.
- C. Maintain reinforcing in proper position during concrete placement operations.
- D. Consolidate concrete, immediately after placing, by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
- E. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface. Do not disturb slab surfaces prior to beginning finishing operations.
- F. Cold Weather Concreting: Protect concrete work from physical damage or reduced strength caused by frost, freezing or low temperatures. Comply with ACI 306.1.
- G. Hot Weather Concreting: When hot weather conditions exist that would impair quality and strength of concrete, reduce delivery time of ready-mix concrete, lower the temperature of materials, or add retarder to ensure that the concrete is plastic. Retempering with water is not allowed. Comply with ACI 305R.

### **3.04 FINISH OF FORMED SURFACES**

- A. Rough Form Finish: Provide where formed concrete surfaces are not exposed to view. Tie holes and surface imperfections shall be repaired and patched and fins and other projections exceeding ¼ inch in height rubbed down or chipped off.

### **3.05 FINISH OF HORIZONTAL SURFACES**

- A. At tops of foundation walls and grade beams finish with a texture matching adjacent formed surfaces unless otherwise indicated.

### **3.06 SLAB FINISHES**

- A. Float Finish: Begin floating when surface water has disappeared and when concrete has stiffened sufficiently to permit operation of power-driven or hand floats. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding ¼ inch in 10 feet when tested with a 10-foot straightedge.
- B. Scratch Finish: Apply scratch finish to slab surfaces that are to receive floor topping. Roughen surface before final set, using stiff brushes, or brooms.
- C. Trowel Finish: Apply trowel finish to all slab surfaces unless noted otherwise. After floating, begin first trowel finish using a power-driven or hand trowel. Finish concrete surface by a final hand-trowel operation, free of trowel marks, and uniform in texture and appearance. The final surface finish for slabs-on-grade shall have a minimum FF = 25 and a minimum FL = 20 per ACI requirements. Verify with Architectural requirements.
- D. Broom Finish: Apply on exterior slabs, ramps, steps, and sidewalks. Immediately after concrete has received a float finish, draw a broom or burlap belt across the surface to give a coarse transverse scored texture.

### **3.07 CONCRETE CURING AND PROTECTION**

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Continue curing for at least 7 days.
- B. Moisture-retaining Cover curing: All interior concrete slabs, except exposed integrally colored concrete slabs, are to be cured with a moisture retaining cover for the first 7 days. After that time, the cover shall be removed, and the slab should be allowed to dry. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed. Repair any holes or tears in cover during curing period.
- C. Curing compound: At contractor's option, exterior concrete slabs may be cured using curing compound. All vertical concrete (walls, beams, etc...) shall be cured using curing compound – apply compound to the vertical surface as soon as the forms are removed. Apply curing compound uniformly in accordance with the manufacturer's printed instructions. Curing compound shall NOT be used on interior slabs, except exposed integrally colored concrete slabs.
- D. Exposed integrally colored concrete slabs: Use curing compound recommended by the concrete supplier. Apply with an airless sprayer.

### **3.08 CONCRETE SURFACE REPAIRS**

- A. Patching Surface Imperfections: Remove loose material and patch surface imperfections and holes left by tie rods with cement mortar. Surface imperfections include honeycomb, excessive air voids, sand streaking and cracks.

### **3.09 FOR EXPOSED-TO-VIEW SURFACES**

- A. Blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

### 3.10 FIELD QUALITY CONTROL

- A. The Owner shall employ the services of a qualified testing laboratory to perform tests and submit test reports.
- B. Sampling Fresh Concrete: ASTM C 172.
- C. Slump: ASTM C 143; one test for each set of compressive strength test specimens.
- D. Air Content: ASTM C 173 or C 231 for each set of compressive strength test specimens.
- E. Concrete Temperature: Test hourly when air temperature is 40 degrees F. and below, when 80 degrees F and above; and when compression test specimens are made.
- F. Compression Test Specimen: ASTM C 31, one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field cure test specimens are required. Mold one set of standard cylinders for volume of concrete specified below or fraction thereof.
  - Slabs on Grade or Metal Deck                      30 cubic yards
  - Footings and Stem Walls                              50 cubic yards
  - All Other Locations (unless otherwise noted) 30 cubic yards.
- G. Compressive Strength Tests: ASTM C 39; test 1 specimen at 7 days, 2 specimens at 28 days, and retain one specimen in reserve for later testing. Additional Tests: The testing laboratory will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure as directed by the Architect. The testing laboratory may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by the Architect or Engineer. The Owner shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.
- H. Granular Base Course: ASTM C 136 and ASTM D 4318 for every 500 square yards of building slab area.

**END OF SECTION**



**SECTION 03 4500**  
**PRECAST ARCHITECTURAL CONCRETE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Architectural precast concrete coping.
- B. Supports, anchors, and attachments.

**1.02 RELATED REQUIREMENTS**

- A. Section 04 2000 - Unit Masonry
- B. Section 07 9200 - Joint Sealants: Sealing perimeter and intermediate joints.

**1.03 REFERENCE STANDARDS**

- A. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- E. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2021a.
- F. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric); 2021a.
- G. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.
- H. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2019.
- I. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.
- J. ASTM C150/C150M - Standard Specification for Portland Cement; 2021.
- K. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2017a.
- L. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
- M. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars; 2021.
- N. IAS AC157 - Accreditation Criteria for Fabricator Inspection Programs for Reinforced and Precast/Prestressed Concrete; 2017.
- O. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; 2013.
- P. PCI MNL-120 - PCI Design Handbook; 2017, with Errata (2021).
- Q. PCI MNL-122 - Architectural Precast Concrete: Fully Revised Manual Including New Sections, Extensive Updates, and Detailed Specifications to Meet Today's Construction Needs; 2007.
- R. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988.
- S. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

- B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.
- C. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials. Provide erection drawings.
  - 1. Include details of mix designs.
  - 2. Include structural design calculations.
- D. Samples: Submit finish sample for each type, 12 x12 inch in size, illustrating surface finish, color and texture.
- E. Fabricator's Qualification Statement: Provide documentation showing precast concrete fabricator is accredited under IAS AC157.

### **1.06 QUALITY ASSURANCE**

- A. Design Engineer Qualifications: Design precast concrete units under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in Nevada.
- B. Fabricator Qualifications:
  - 1. Firm having at least 2 years of documented experience in production of precast concrete of the type required.
  - 2. Plant certified under Architectural Precast Association Plant Certification Program for production of architectural precast concrete.
  - 3. Fabricator Qualifications: Precast concrete fabricator accredited by IAS according to IAS AC157.
- C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Handling: Lift and support precast units only from support points.
- B. Protect units to prevent staining, chipping, or spalling of concrete.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Architectural Precast Concrete:
  - 1. COPILING: Any manufacturer holding a PCI Group A Plant Certification for the types of products specified; see [www.pci.org/#sle](http://www.pci.org/#sle).

### **2.02 PRECAST UNITS, GENERAL**

- A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.
  - 1. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
  - 2. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.
  - 3. Bollards shall perform as vehicle barriers and shall follow DOT requirements.
- B. Finish Type Smooth: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance.

### **2.03 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi).
  - 1. Deformed billet-steel bars.
  - 2. Epoxy coated in accordance with ASTM A775/A775M.

### **2.04 CONCRETE MATERIALS**

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

- B. Fine and Coarse Structural Aggregates: ASTM C33/C33M.
- C. Lightweight Structural Aggregate: ASTM C330/C330M.
- D. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
  - 1. Color(s): As selected by Architect from manufacturer's full range.

## **2.05 SUPPORT DEVICES**

- A. Connecting and Support Devices; Anchors and Inserts: ASTM A36/A36M steel; hot-dip galvanized in accordance with ASTM A153/A153M.
  - 1. Clean surfaces of rust, scale, grease, and foreign matter.
- B. Bolts, Nuts, and Washers: ASTM A307 heavy hex bolts, Type A, hot-dip galvanized, with matching ASTM A563 (ASTM A563M) nuts and matching washers.
- C. Primer: Zinc rich type.

## **2.06 ACCESSORIES**

- A. Bearing Pads: High density plastic; 1/8 inch thick, smooth both sides.

## **2.07 FABRICATION**

- A. Fabricate in compliance with PCI MNL-117 and PCI MNL-135.
- B. Fabricate and handle epoxy-coated reinforcing bars in accordance with ASTM D3963/D3963M.

## **2.08 FABRICATION TOLERANCES**

- A. Conform to PCI MNL-117 and PCI MNL-135.

## **2.09 SOURCE QUALITY CONTROL**

- A. Provide testing of concrete mix.

## **PART 3 EXECUTION**

### **3.01 DELIVERY**

- A. Protect product so as to prevent cracks or other breakage during transport and final delivery.

### **3.02 EXAMINATION**

- A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

### **3.03 PREPARATION**

- A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

### **3.04 ERECTION**

- A. Erect units without damage to shape or finish. Replace or repair damaged panels.
- B. Erect units level and plumb within allowable tolerances.
- C. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise Architect.
- D. Fasten units in place with mechanical connections.

### **3.05 TOLERANCES**

- A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-135.

**END OF SECTION**

**SECTION 04 2200**  
**REINFORCED UNIT MASONRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. This section includes the construction of reinforced hollow core unit masonry, masonry veneer and special shapes. It includes all split face units and smooth face units, as well as masonry mortar and grout.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 20 00 - Concrete Reinforcement
- B. Division 07 Section "Water Repellents" for water repellents applied to unit masonry assemblies.
- C. Division 07 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
- D. Division 07 Section "Fire stopping" for fire stopping at tops of masonry walls and at openings in masonry walls.
- E. Division 08 Section "Louvers and Vents" for wall vents (brick vents).
- F. Products furnished, but not installed, under this Section include the following:
  - 1. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 05 Section "Structural Steel" and Division 13 Section "Metal Building Systems".
- G. Products installed, but not furnished, under this Section include the following:
  - 1. Cast-stone trim, furnished under Division 04 Section "Cast Stone".
  - 2. Steel lintels for unit masonry, furnished under Division 05 Section "Metal Fabrications".
  - 3. Manufactured reglets in masonry joints for metal flashing, furnished under Division 07 Section "Sheet Metal Fabrications".
  - 4. Hollow-metal frames in unit masonry openings, furnished under Division 08 Section "Steel Doors and Frames".

**1.03 REFERENCE STANDARDS**

- A. ASTM International (ASTM), latest versions;
  - 1. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
  - 2. ASTM C90 - Standard Specification for Load bearing Concrete Masonry Units
  - 3. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and reinforced Masonry
  - 4. ASTM C270 - Standard Specification for Mortar for Unit Masonry
  - 5. ASTM C476 - Standard Specification for Grout for Masonry
  - 6. ASTM C1019 - Standard Test Method for Sampling and Testing Grout
- B. American Concrete Institute (ACI), latest versions:
  - 1. ACI 530.1 - Specification for Masonry Structures

**1.04 SUBMITTALS**

- A. Product Data: Submit sample of exposed masonry unit of each color and texture to be used to complete the work. Submit copies of test reports performed within last 12 months for representative specimens to be used in accordance with ASTM C 140 for strength, absorption and moisture content, and ASTM C 426 for drying shrinkage.
- B. Test Reports: Submit copies of test reports for masonry units, mortar and grout.

## **1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Store masonry units above ground on level platforms, which allows air circulation under stacked units.
- B. Cover and protect against wetting prior to use.
- C. Handle units on pallets or flatbed barrows.
- D. Store cementitious ingredients in weather-tight enclosures.
- E. Waste Management and Disposal: As specified in Division 01 Section "Construction Waste Management" and as follows:
  - 1. Separate and recycle waste materials in accordance with the Waste Management Plan and to the maximum extent economically feasible.
    - a. Fold up metal banding; flatten and place in designated area for recycling.
    - b. Collect wood packing shims and pallets, place in designated area.
  - 2. Recycling: Undamaged, excess masonry materials are Contractor's property and shall be removed from the Project site for his use.
  - 3. Disposal as Fill Material: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil contaminated sand, by crushing and mixing with fill material as fill is placed.
    - a. Crush masonry waste to less than 2 inches in greatest dimension.
    - b. Mix masonry waste with at least 2 parts specified fill material for each part masonry waste. Fill material is specified in Division 31 Section "Earth Moving".
    - c. Do not dispose of masonry waste as fill within 18 inches of finished grade.
  - 4. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste and legally dispose of off Owner's property.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Hollow Core Split Faced Scored Units: ASTM C 90.
- B. Hollow Core Units: ASTM C90.
- C. Aggregate: Natural color at concealed block.
- D. Mortar: ASTM C 270 "Standard Specification for Mortar for Unit Masonry," Type S,  $f_c = 1800\text{psi}$ .
- E. Grout: ASTM C 476 "Standard Specification for Grout for Masonry."
- F. Cell Reinforcing: ASTM A 615 "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement," Grade 60. Comply with Section 03 20 00.
- G. Bond Beam and Lintel Reinforcing: ASTM A 615, Grade 60. Comply with Section 03 20 00.
- H. Joint Reinforcing: Hot Dipped Galvanized, Standard Ladder Type 9 Gage Wire Dur-O-Wal or approved equal.
- I. Control Joint Material: Rubber, neoprene or PVC joint material for use with standard sash block by Dur-O-Wal or approved equal.
- J. Vertical Bar Positioner: Steel by Dur-O-Wal or approved equal.
- K. Mortar Plasticizer: Easy Spread by American Colloid Company or approved equal.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Provide jamb, header, lintel, bond beam, etc. units as required to complete the work. Lay only dry and unfrozen masonry units.
- B. All exposed masonry shall be scoria aggregate, split face, scored finish unless noted otherwise on the drawings. Masonry not exposed to view may be smooth finished.

- C. Discard any broken, chipped, or discolored masonry units.
- D. Use masonry saws to cut and fit masonry units.
- E. Lay units in running bond pattern with vertical joints located at center of masonry units in alternate course below.
- F. Set units plumb, true to line and with level courses accurately spaced.
- G. Adjust masonry unit to final position while mortar is soft and plastic.
- H. Anchors, flashing accessories and similar devices shall be built in as masonry progresses.

### **3.02 MORTAR**

- A. Mix all cementitious materials and sand in a mechanical batch mixer for a minimum of 5 minutes. Adjust the consistency of the mortar to the satisfaction of the mason, but add only as much water as is compatible with convenience in using the mortar. If the mortar begins to stiffen from evaporation or from absorption of a pat if the mixing water, re-temper the mortar immediately by adding water, and remix the mortar.
- B. Mortar for exterior walls shall have waterproofing added in accordance with the manufacturer's recommendations.
- C. Addition of admixtures or re-tempering of mortar at the mixer to extend its use will not be permitted.

### **3.03 RE-TEMPERING**

- A. All mortar shall be used within 2-1/2 hours of initial mixing and no mortar shall be used after it has begun to set. Re-tempering of mortar in which setting has saturated will not be permitted. However, mortar shall be re-tempered, except as above qualified, as necessary to keep it plastic.

### **3.04 JOINTS**

- A. Provide joints 3/8-inch nominal thickness and tooled unless shown otherwise on drawings.
- B. Construct uniform joints.
- C. Units shall be placed with sufficient pressure to extrude mortar and provide a tight joint.

### **3.05 REINFORCEMENT**

- A. Reinforcement shall be secured against displacement prior to grouting at a spacing not greater than 4 feet.
- B. Provide rebar lap lengths specified in the General Structural Notes on the drawings. Provide 6 inches minimum lap for all ladder type joint reinforcing.

### **3.06 GROUTING**

- A. Grout all cells, which are below grade.
- B. Grout lintel blocks over masonry openings and each jamb of masonry openings.
- C. Grout pours shall not exceed 5 feet in height.
- D. Grout all cells solid, which contain reinforcing.

Grout shall have a slump range of 8 to 11 inches tested in accordance with ASTM C143.

Consolidate grout pours 12 inches or less in height by mechanical vibration or by puddling. Consolidate pours exceeding 12 inches in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred. Typically, this occurs within 2-4 minutes of placement of grout.

Place grout within 1-1/2 hours from introducing water in the mixture and prior to initial set.

### **3.07 POINTING AND CLEANING**

- A. At completion of unit masonry work, fill holes in joints and tool.
- B. Cut out and repoint defective joints.

- C. Dry brush masonry surface after mortar has set at end of each day's work and after final pointing.
- D. Leave work and surrounding surfaces clean and free of mortar spots and droppings.

### **3.08 PROTECTION OF WORK**

- A. Protect sills, ledges, and offsets from mortar drippings or other damage during construction.
- B. Remove misplaced mortar or grout immediately.
- C. Cover top of walls with non-staining waterproof coverings when work is not in progress.
- D. Provide adequate bracing during construction to prevent damage from wind loads.

### **3.09 WEATHER CONDITIONS**

- A. Do not place concrete masonry units when air temperature is below 20 degrees F.
- B. For temperatures between 20 degrees F and 40 degrees F, sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F. Mortar shall be maintained above 32 degrees F during placement.
- C. Masonry shall be protected from freezing for 24 hours after placement.

### **3.10 FIELD QUALITY CONTROL**

- A. The Owner shall employ the services of a qualified testing laboratory to perform tests and submit test reports.
- B. Concrete Masonry Units (CMU): Test in accordance with ASTM C 140. "Standard Test Methods of Sampling and Testing Concrete Masonry Units." Six units shall be sampled and tested for each lot of 10,000 units or less delivered to the job site. Twelve units shall be sampled from each lot of more than 10,000 units and less than 100,000 units.
- C. Mortar: By proportions according to ASTM C 780 "Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Masonry."
- D. Grout: Mold and test 4 test specimens in accordance with ASTM C 1019 "Test Method for Sampling and Testing Grout" from each day's grout placement. Test grout slump prior to each day's grouting process. Submit slump value with test specimen results. See General Structural Notes for required strength.

**END OF SECTION**

**SECTION 04 2300**  
**GLASS UNIT MASONRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Glass masonry units.
- B. Setting and pointing materials.
- C. Perimeter treatment.

**1.02 REFERENCE STANDARDS**

- A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.
- B. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- C. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2010.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for glass units and accessories.
- C. Samples: Submit two glass units illustrating color, design, and face pattern.
- D. Manufacturer's Installation Instructions: Indicate special procedures, positioning of reinforcement, perimeter conditions requiring special attention.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Accept glass units on site on pallets; inspect for damage.

**1.06 FIELD CONDITIONS**

- A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Glass Units:
  - 1. Nippon Electric Glass Co. Ltd: [www.neg.co.jp/arch](http://www.neg.co.jp/arch).
  - 2. Weck Glass Blocks: [www.glashaus.com](http://www.glashaus.com).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 GLASS UNITS**

- A. Hollow Glass Units: Permanently seal hollow unit by heat fusing joint; with joint key to assist mortar bond.
  - 1. Provide specially shaped units where indicated, including corners, curved units, and end units.
  - 2. Nominal Size: 8 inch by 8 inch by 6 inch.
  - 3. Color: Frosted glass.
  - 4. Pattern and Design: To be selected by Architect from manufacturer's full line.
  - 5. Insulation Value: U-value to comply with applicable building code requirements for glazed fenestration's.
  - 6. Compressive Strength: 400-600 psi.



### **2.03 MORTAR AND POINTING MATERIAL**

- A. Mortar: ASTM C270, Type M using the Proportion specification.
- B. Pointing Mortar: ASTM C270, Type M using the Proportion specification with maximum 2 percent ammonium stearate or calcium stearate per cement weight, with beach sand aggregate.
- C. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
  - 1. Color(s): As selected by Architect from manufacturer's full range.

### **2.04 MORTAR MIXING**

- A. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
- B. Add mortar color in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.
- D. If water is lost by evaporation, re-temper only within two hours of mixing.
- E. Use mortar within two hours after mixing at temperatures of 90 degrees F, or two-and-one-half hours at temperatures under 40 degrees F.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that openings are ready to receive work.

### **3.02 PREPARATION**

- A. Clean glass units of substances that may impair bond with mortar or sealant.
- B. Establish and protect lines, levels, and coursing.
- C. Protect elements surrounding the work of this section from damage and disfigurement.

### **3.03 INSTALLATION**

- A. Erect glass units and accessories in accordance with manufacturer's instructions.
- B. Locate and secure perimeter metal channel.
- C. Provide full mortar joints. Furrowing is not permitted. Remove excess mortar.
- D. Maintain uniform joint width of 1/4 inch.
- E. Pointing With Mortar:
  - 1. Before mortar sets, rake out joints to depth of 5/8 to 3/4 inch.
  - 2. Fill joints with pointing mortar; press into joint to eliminate voids; neatly tool surface to a concave profile.
  - 3. Remove excess pointing mortar.

### **3.04 CLEANING**

- A. Clean and polish faces of glass unit masonry, using materials and technique that will not scratch or deface units.

**END OF SECTION**

**SECTION 04 2616**  
**ADHERED MASONRY VENEER**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Thin Ledge Stone panels
- B. Mortar.
- C. Adhesives.
- D. Accessories.

**1.2 RELATED REQUIREMENTS**

- A. Section 05 4000 - Cold-Formed Metal Framing: Steel stud backup for masonry veneer.
- B. Section 06 1000 - Rough Carpentry: Wood stud backup for masonry veneer.
- C. Section 07 6200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- D. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

**1.3 REFERENCE STANDARDS**

- A. ANSI A108/A118/A136.1 - Specifications for the Installation of Ceramic Tile; 2020.
- B. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2021.
- C. ANSI A136.1 - American National Standard for Organic Adhesives for Installation of Ceramic Tile; 2020.
- D. ASTM C91/C91M - Standard Specification for Masonry Cement; 2018.
- E. ASTM C150/C150M - Standard Specification for Portland Cement; 2021.
- F. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
- G. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring; 2003 (Reapproved 2018).
- H. ASTM C847 - Standard Specification for Metal Lath; 2018.
- I. ASTM C1088 - Standard Specification for Thin Veneer Brick Units Made From Clay or Shale; 2020.
- J. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
- K. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
- L. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2021.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week before starting work of this section.

**1.5 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for thin brick units, mortar, grout, and adhesive.
- C. Samples: Submit four samples of thin brick units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that thin brick units, adhesives, mortar, and grout meet or exceed specified requirements.

**1.6 QUALITY ASSURANCE**

- A. Maintain one copy of the ANSI A108/A118/A136.1 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

- C. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

#### **1.7 MOCK-UP**

- A. Construct a mock-up panel sized 8 feet long by 6 feet high; include mortar, grout, adhesives, accessories, substrate, and representative wall openings in mock-up.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

#### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.
- B. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

#### **1.9 FIELD CONDITIONS**

- A. Do not install adhesives in an unventilated environment.
- B. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

### **PART 2 PRODUCTS**

#### **2.1 THIN STONE PANELS**

- A. Thin Stone Panels (Exterior): ASTM C1088
  - 1. Panel Type: Stacked Stone - Dry Stack
  - 2. Size: Manufacturer's standard panels 6"x24"
  - 3. Stone Type: Quartzite
  - 4. Thickness: 0.75" to 1.75"
  - 5. Weight: 12.5 LBS per SF
  - 6. Color: Exterior: Standard Mix; Ochre Blend which includes browns, smokey grays, deep reds and rust colored accents with occasional pale yellows, greens and oranges. Exact color to be selected by Architect.
  - 7. Manufacturers:
    - a. Basis of Design: NORSTONE: Stone Veneer Rock Panel System: [www.norstoneusa.com/products/stacked-stone-cladding](http://www.norstoneusa.com/products/stacked-stone-cladding).
    - b. NATURAL STONE VENEER: Ledge Stone Natural Stone Veneer: [www.naturalstoneveneer.com](http://www.naturalstoneveneer.com).
    - c. CULTURED STONE: Drystack Ledge Stone Panel: <https://www.culturedstone.com/profile/drystack-ledgestone-panel/>
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Thin Stone Panels (Interior):
  - 1. Panel Type: Natural Stone Mesh Mount
  - 2. Size: Manufacturer's standard panels: 5 7/8"x24"
  - 3. Stone Type: Travertine
  - 4. Color: Scabos Split
  - 5. Manufacturers:
    - a. Basis of Design: ARIZONA TILE: 3D Mesh Mount Stack: <https://www.arizonatile.com/products/tile/decorative-mosaics-mesh-mounts/natural-stone-mosaics-mesh-mounts/3d-mesh-mount-stack>
    - b. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.2 ADHESIVE MATERIALS**

- A. Manufacturers:

1. LATICRETE International, Inc; LATICRETE MVIS Hi-Bond Mortar:  
[www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Organic Adhesive: ANSI A136.1, thinset bond type; use Type I in areas subject to prolonged moisture exposure.
- C. Epoxy Adhesive: ANSI A118.3, thinset bond type.
- D. Thin Brick Setting Adhesive: Elastomeric, waterproof, liquid applied.

### **23 MORTAR MATERIALS**

- A. Masonry Cement: ASTM C91/C91M Type N.
1. Colored mortar: Premixed cement as required to match Architect's color sample.
- B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
- C. Water: Clean and potable.
- D. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.

### **24 MORTAR MIXES**

- A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.
1. Exterior, non-loadbearing masonry: Type N.
  2. Interior, non-loadbearing masonry: Type O.
- B. Mixing: Use mechanical batch mixer and comply with referenced standards.

### **25 FLASHINGS**

- A. Metal Flashing Materials: Lead, as specified in Section 07 6200.
- B. Rubberized Asphalt Flashing: Self-adhering composite material comprising rubberized asphalt adhesive compound bonded to cross-laminated polyethylene film, minimum 0.030 inch total thickness.

### **26 LATH**

- A. Diamond Mesh Metal Lath: ASTM C847, galvanized; unfurred.
1. Weight: To suit application, comply with deflection criteria and as specified in ASTM C841 for framing spacing.
  2. Weight: 2.5 lb/sq yd, minimum.

### **27 ACCESSORIES**

- A. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
- B. Air and Water Barrier: Single component, fluid applied, vapor permeable; waterproofing, crack isolation, and air barrier membrane.
1. Manufacturers:
    - a. LATICRETE International, Inc; LATICRETE MVIS Air & Water Barrier:  
[www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - b. Substitutions: See Section 01 6000 - Product Requirements.

## **PART 3 EXECUTION**

### **31 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive thin brick veneer.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for installation of thin brick veneer.

### **32 INSTALLATION**

- A. Interior Applications: Comply with TCNA (HB) Method W211, W221, W222, W223, W231, W241, W242, W243, W244C, W244F, W245, W246, or W247.
- B. Exterior Applications: Comply with TCNA (HB) Method W201, W202, or W244E.
- C. Install interior lath and furring in accordance with ASTM C841.

- D. Lath Installation:
1. Apply metal lath taut, with long dimension perpendicular to supports.
  2. Lap ends minimum 1 inch. Secure end laps with tie wire where they occur between supports.
  3. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.
  4. Place corner bead at external wall corners; fasten at outer edges of lath only.
  5. Place 4 inch wide strips of metal lath centered over junctions of dissimilar backing materials. Secure rigidly in place.
  6. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.
  7. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

### **33 COURSING**

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

### **34 PLACING AND BONDING**

- A. Remove excess mortar as work progresses.
- B. Place units in strict compliance with manufacturer's pattern layout and utilize correct specialty units at outside corners and openings.
- C. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove and replace.
- D. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

### **35 MASONRY FLASHINGS**

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
  1. Extend flashings full width at such interruptions at least 6 inches, minimum, to form watertight pan.
  2. Seal lapped ends and penetrations of flashing before covering with mortar.

### **36 CONTROL AND EXPANSION JOINTS**

- A. Form joints as detailed on drawings and/or as required by manufacturer.

### **37 TOLERANCES**

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
- C. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
- D. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

### **38 CUTTING AND FITTING**

- A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

### **39 CLEANING**

- A. Remove excess mortar and mortar smears as work progresses.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

**3.10 PROTECTION**

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**

**SECTION 05 1000  
STRUCTURAL STEEL**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. This section includes the fabrication and erection of structural steel.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 30 00 - Metal Deck
- B. Section 09 90 00 - Painting and Coating

**1.03 REFERENCE STANDARDS:**

- A. ASTM International (ASTM), latest versions:
  - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel
  - 2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded Seamless
  - 3. ASTM A61/A61M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
  - 4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
  - 5. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
  - 6. ASTM A490 - Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
  - 7. ASTM A500-A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
  - 8. ASTM A992/A992M - Standard Specification for Structural Steel Shapes
  - 9. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (non-shrink)
  - 10. ASTM F1554 AE1 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- B. American Welding Society (AWS), latest edition
  - 1. AWS D1.1 Structural Welding Code-Steel
- C. American Institute of Steel Construction (AISC), Steel Construction Manual, latest edition.
  - 1. Specification for Structural Steel Buildings
  - 2. AISC Code of Standard Practice
  - 3. Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.

**1.04 QUALITY ASSURANCE**

- A. Qualifications of Fabricator: Fabricator shall have a minimum of 5 years' experience in the fabrication of structural steel of structures of similar size. Fabricator shall have AISC or IAS certification or other certification as approved by the building official and the engineer of record. If the fabricator does not have approved certification, special inspection shall be done on the fabrication process and on the fabricated material as required by Section 1704.2, Inspection of Fabricators of the International Building Code. The non-certified fabricator shall engage a special inspector that meets the requirements of IBC section 1704.1 and is acceptable to the building official and the engineer of record. Provide documentation verifying certification or provide special inspector information for approval prior to issuance of a building permit.
- B. Qualifications of Erector: Erector shall have a minimum of 5 years' experience in the erection of structural steel of structures of similar size.

- C. Qualifications of Field Welders: Welders shall be certified in accordance with AWS D1.1 within the last 12 months.

#### **1.05 SUBMITTALS**

- A. Shop Drawings: Submit shop drawings including erection plans, complete details and schedules for fabrication and assembly of structural steel members. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Shop drawings shall not be made by reproduction of the Contract Drawings.
- B. Provide setting drawings and directions for installation of anchor bolts and other anchorages to be installed by others.
- C. Welder Certification: Submit affidavit stating that all welders are certified in accordance with AWS and provide copies of welder's certificates.

#### **1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Support structural steel above ground on skids, pallets, platforms, or other supports.
- B. Protect steel from damage.
- C. Store packaged materials in original unbroken package or container.
- D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures.
- E. Replace damaged shapes or members.
- F. Waste Management and Disposal; As specified in Division 01 Section "Construction Waste Management" and as follows: Collect cut offs and scrap and place in designated area for recycling in accordance with the Waste Management Plan and local recycler standards.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. All Wide Flange Shapes shall conform to ASTM A 992, Grade 50 unless noted otherwise.
- B. All Angles, Channels, Plates, and Bars: ASTM A 36.
- C. Structural Steel Pipe: ASTM A 53, Type E or S, Grade B  $F_y=35$  ksi
- D. Rectangular or Square Hollow Structural Section: ASTM A 500, Grade B,  $F_y=46$  ksi.
- E. Round Hollow Structural Sections: ASTM A 500, Grade B,  $F_y=42$  ksi.
- F. Anchor Bolts: ASTM F1554, Grade 36
- G. High Strength Tension Control Threaded Fasteners: Meet requirements of ASTM A 325 or ASTM A 490.
- H. Headed Anchor Shear Studs: By the Nelson Division of TRW.
- I. Welding Electrodes: E 70 Series.
- J. Shop Primer Paint: Fabricators standard rust inhibitive primer.
- K. Non-Metallic, Non-Shrink Grout: Meets the requirements of ASTM C 1107.
- L. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time. Grout shall have a minimum 28-day compressive strength of 6,000 psi.
  - 1. Subject to compliance with requirements, provide products by one of the following or an approved equal:
    - a. Five Star Fluid Grout 100; Five Star Products, Inc., Fairfield, Connecticut.
    - b. Crystex; L&M Construction Chemicals, Inc. Omaha, Nebraska.
    - c. Sure-Grip High Performance Grout; Dayton superior Corp., Miamisburg, Ohio.
    - d. Sonnogrout 10K; Sonneborn Building Products, Shakopee, Minnesota.
    - e. Sealight Pac-It Grout; W.R. Meadows, Inc., Hampshire, Illinois.



- f. Enduro 50; Conspec Marketing & Manufacturing Co., Inc, Kansas City, Kansas.

## **2.02 FABRICATION**

- A. Fabrication shall be in accordance with the AISC "Code of Standard Practice for Buildings and Bridges".
- B. Connections: Weld or bolt shop connections as indicated on the approved shop drawings. Design connections to support reactions and forces where indicated on the drawings.
- C. Shop Welds: Shall be visually inspected by the Fabricator's quality control department.

## **2.03 SHOP PAINTING**

- A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete, mortar or to receive sprayed on fireproofing. Paint embedded steel, which is partially exposed on exposed portions and initial 2 inch of embedded areas only.
- B. Do not paint surfaces, which are to be welded or high-strength bolted with friction-type connections.
- C. Surface Preparation: After inspection and before shipping, clean steel work to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
  - 1. SP-1 "Solvent Cleaning"
  - 2. SP-2 "Hand Tool Cleaning"
  - 3. SP-3 "Power Tool Cleaning". For Architecturally Exposed Structural Steel, AESS, see Architectural drawings for locations and AESS Level.
- D. Painting: After surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions. Provide one coat.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. Field Measurements: Verify all elevations, locations, and dimensions of surfaces to receive structural steel.
- B. Anchor Bolts and Other Embedded Items: Verify locations and positions of anchor bolts and other embedded items used to support structural steel.

All Anchor bolts for column base plates, anchors and bearing plates for beams shall be located prior to installation by a Registered Professional surveyor. The Professional Surveyor shall use project control points, such as benchmarks, grid lines, or building corners established and accurately maintained by the General Contractor for vertical and horizontal control of location. Templates shall be used to locate groupings of bolts or anchors and shall be confirmed as to orientation and hole geometry accuracy.

Anchor bolts and bearing plates with anchors shall be stabilized against movement, vertical and horizontal, prior to and during concrete casting of concrete supporting these devices.

Upon completion of the concrete casting the Professional Surveyor shall verify vertical and horizontal locations and orientation of anchor bolts or bearing plates with anchors. A report shall be furnished to the Engineer of Record (through the General Contractor and Architect) noting non-compliant locations. The EOR, will furnish remedial actions required to correct the non-compliant anchor bolt or bearing plate locations. Allow ten days for the EOR's report on remedial actions necessary.

It shall be the General Contractor's responsibility to have this work performed.

- C. Correct any unsatisfactory conditions prior to erection of structural steel.

### **3.02 PREPARATION**

- A. Clean surfaces to receive structural steel prior to erection.

### **3.03 ERECTION**

- A. General: Erect structural steel in accordance with AISC "Code of Standard Practice for Steel Buildings and Bridges".
- B. Field Assembly: Assemble structural steel accurately to the lines and elevations shown on the drawings. Align and adjust components accurately before fastening.
- C. Temporary Bracing: Provide temporary bracing or guys to secure structural steel against wind, seismic, or construction loads. It is the responsibility of the Contractor to maintain stability of the structure during erection.
- D. Field Bolted Connections: Install high strength tension control bolts in accordance with AISC Specifications for Structural Joints Using ASTM A325 and A490 Bolts and the manufacturer's instructions. Where clearance within a connection does not permit the use of tension control bolts, standard A325 bolts shall be used and inspected in accordance with the AISC Specification for Structural Joints.
- E. Field Welding: Perform all welds in accordance with AWS.
- F. Welded Connections: Field welds shall be visually inspected according to AWS D1.1/D1.1M.
  - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94
- G. Gas Cutting: Do not use gas-cutting torches in field to cut structural framing.
- H. Do not enlarge unfair holes by burning. Ream holes that must be enlarged to admit bolts.
- I. Field Touch-up Painting (Primer): Paint all exterior exposed bolts, washers, and nuts after connections have been tightened and checked. Paint all exterior exposed field welds. Paint all exterior exposed abrasions in shop coat. Use same paint as for shop painting.
- J. Grout Placement: Comply with the manufacturer's instructions.
- K. Tighten anchor bolts after supported members have been positioned and plumbed.

**END OF SECTION**

**SECTION 05 7000  
DECORATIVE METAL**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Overhead Shade Canopy Panels

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1323 - Heavy Timber Framing.
- B. Section 09 9000 - Painting and Coating

**1.03 REFERENCE STANDARDS**

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021, with Errata (2022).
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Meeting: Schedule and conduct a preinstallation meeting one week before starting work of this section. Attendees shall include, but not be limited to:
  - 1. Contractor.
  - 2. Manufacturer's representative.
  - 3. Architect.
  - 4. Owner's representative.
  - 5. Other subcontractors of adjacent work.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's product data including description of materials, components, finishes, fabrication details, mounting hardware, anchors, and accessories.
- C. Shop Drawings: Indicate panel system plans, elevations and sections, details of profile, dimensions, sizes, connection attachments, mounting hardware, anchorage, size and type of fasteners, and accessories. Indicate anchor points, panel joint locations and terminations.
- D. Samples: Submit one (1) of each item below for each type and condition shown.
  - 1. Panel: 24 inch by 24 inch, illustrating color, thickness and edge conditions.
  - 2. Mounting Hardware: One (1) of each type illustrating color, finish and connection detail.
- E. Manufacturer's Installation Instructions.
- F. Maintenance Data: Manufacturer's instructions for care and cleaning.
- G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.06 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installing decorative metal panels as canopies and acceptable to manufacturer.
- B. Templates: Supply installation templates, reinforcing, and required anchorage devices.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in factory-provided protective coverings and packaging.
- B. Protect materials against damage during transit, delivery, storage, and installation at site.

- C. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.
- D. Prior to installation, store materials and components under cover in a dry location.

### **1.08 WARRANTY**

- A. Warranty: Manufacturer's standard one year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Decorative Overhead Shade Metal Panels - See hotel roof plan for location.
  - 1. Parasoleil. <https://www.parasoleil.com> +1 303-589-4524.
    - a. Basis of Design: Parasoleil Shade Aluminum Panels - with PFL series installation hardware. Panel Size Typ. 4'x8' and custom sizes as designed.

### **2.02 MATERIALS**

- A. Aluminum:
  - 1. Material: AA 5000 series, H32 temper, aluminum with recycled content of 60 percent.
  - 2. Finish: Factory-applied Powder Coated
    - a. Performance: AAMA 2604
    - b. Color category: Manufacturer's Venerable Powders: Cor-11.
    - c. Pattern: bb Leaves.

### **2.03 ACCESSORIES**

- A. Clips: Provide clips or other attachment devices to attach panels to substrate. Design clips to minimize their visibility.
- B. Fasteners:
  - 1. Attachment to Steel: Bi-metal, self-drilling, self-tapping screws:
    - a. Fasteners shall be immune to hydrogen-assisted stress-corrosion cracking.
    - b. Head and Shank: Non-magnetic, 300 series stainless steel.
    - c. Drill Point: Carbon steel.
    - d. Galvanic Barrier Coating with zinc-rich baked-on polymer base coat and aluminum-rich baked-on polymer top coat.
    - e. Salt-Spray Resistance: No red rust after 1000-hour in accordance with ASTM B117.
  - 2. Color: Color of exposed-to-view fasteners in surfaces with factory-applied finishes shall be compatible with panel finish.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate and site conditions are acceptable and ready to receive work.
- B. Verify field dimensions of locations and areas to receive work.
- C. Notify Architect immediately of conditions that would prevent satisfactory installation.
- D. Do not proceed with work until detrimental conditions have been corrected.
- E. Furnish components to be installed in other work to installer of that other work, including but not limited to supports for attachment of hardware if required.

### **3.02 PREPARATION**

- A. Protect existing work.
- B. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions, and directions for installation of anchorages and fasteners.
- C. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

### **3.03 INSTALLATION**

- A. Comply with manufacturer's drawings and written instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.
- C. Anchor securely to structure.
- D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- E. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

### **3.04 CLEANING**

- A. Remove protective film from exposed metal surfaces.
- B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage the material or finish.

### **3.05 PROTECTION**

- A. Protect installed components and finishes from damage after installation.
- B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
  - 1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

**END OF SECTION**

**SECTION 06 0660**  
**TRANSLUCENT RESIN PANEL SYSTEM**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SECTION INCLUDES**

- A. This Section includes the Plastic Fabrication as shown and specified in the described system(s):
  - 1. Exterior Canopy/Roof Panels:
  - 2. Suspended Panels:
    - a. Privacy Screens
    - b. Signage
  - 3. Wall Panels:
    - a. Signage

**1.03 RELATED REQUIREMENTS**

- A. Section 06 4100 Architectural Wood Casework; Resin panels incorporated into casework.
- B. Section 09 2116 Gypsum Board Assemblies; Resin panels suspended from gypsum board assemblies.
- C. Section 10 1400 Signage; Suspended and Wall Mounted resin panels for signage.
- D. Section 12 3600 Countertops; Resin panels incorporated into countertops.

**1.04 SUBMITTALS**

- A. General: Submit the following in accordance with conditions of contract and Division 1 specification section 01 3000 Administrative Requirements.
- B. Product Data: Submit manufacturer's product data; include product description, fabrication information, and compliance with specified performance requirements.
- C. Submit product test reports from a qualified independent 3rd party testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed test reports will be acceptable if for current manufacturer and indicative of products used on this project.
  - 1. Test reports required are:
    - a. Rate of Burning (ASTM D 635)
    - b. Self-Ignition Temperature (ASTM D 1929)
    - c. Density of Smoke (ASTM D 2843)
    - d. Flame spread and Smoke developed testing (ASTM E 84)
    - e. Room Corner Burn Test (NFPA 286)
    - f. Extent of Burning (UL 94)
    - g. Impact strength (ASTM D 3763)
    - h. Safety glazing impact resistance (ANSI Z97.1-2004)
    - i. UPITT Test for Combustion Product Toxicity
    - j. Dynamic environmental testing (ASTM standards D 5116 and D 6670)
- D. Shop Drawings: Include plans, elevations, sections, panel dimensions, details, and attachments to other work.
- E. Samples for Initial Selection:
  - 1. Submit minimum 2-inch by 2-inch samples. Indicate full color, texture and pattern variation.
- F. Samples for Verification:
  - 1. Submit minimum 4-inch by 4-inch sample for each type, texture, pattern and color of solid plastic fabrication.
- G. Mockups:

1. Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects.
  2. Build mockup of each type of Plastic Fabrication.
  3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- H. Maintenance Data: Submit manufacturer's care and maintenance data, including care, repair and cleaning instructions. Include in Project closeout documents.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturers Qualifications
1. Materials and systems shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least five (5) consecutive years and which can show evidence of those materials being satisfactorily used on at least six (6) projects of similar size, scope and location. At least three (3) of the projects shall have been successful for use five (5) years or longer.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver Plastic Fabrications, systems and specified items in manufacturer's standard protective packaging.
- B. Do not deliver Plastic Fabrications, system, components and accessories to Project site until areas are ready for installation.
- C. Store materials in a flat orientation in a dry place that is not exposed to exterior elements.
- D. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent damage or staining following installation for duration of project.
- E. Before installing Plastic Fabrications, permit them to reach room temperature.

#### **1.07 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not install Solid Polymer Fabrications until spaces are enclosed and weatherproof, and ambient temperatures and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

#### **1.08 WARRANTY**

- A. Manufacturer's Special Warranty on Plastic Fabrications: Manufacturer's standard form agreeing to repair or replace units that fail in material or workmanship within the specified warranty period.
- B. Warranty Period: 2 year after the date of substantial completion.
- C. The warranty shall not deprive the owner of other rights or remedies the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURER**

- A. Manufacturers:
1. 3form, Inc., Salt Lake City, Utah, USA / telephone 801-649-2500
  2. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 MATERIALS**

- A. Varia™ produced from Ecoresin™ Sheet - See Interior Material Schedules on sheet ID602 for color and other information.
1. Engineered polyester resin
  2. Sheet Size: Maximum 4' x 10'
  3. Thickness: Minimum 3/8"
  4. Basis of Design Product: The design of Plastic Fabrications is based on Varia™ produced with ecoresin™ as provided by 3form, Inc. Products from other manufacturers must be

approved by the Architect or Designer prior to bidding in accordance with the Instructions to Bidders and Section 01 6000 - Product Requirements.

5. Interlayer Materials: Compatible with polyesters and bonding process to create a monolithic sheet of material when complete.
6. Sheet minimum performance attributes:
  - a. Rate of Burning (ASTM D 635). Material must attain CC1 Rating for a nominal thickness of 1.5 mm (0.060 in.) and greater.
  - b. Self-Ignition Temperature (ASTM D 1929). Material must have a Self-ignition temperature greater than 650°F.
  - c. Density of Smoke (ASTM D 2843). Material must have a smoke density less than 75%.
  - d. Flame spread and Smoke developed testing (ASTM E 84). Material must be able to meet a level of Class A (Flame spread less than 25 and smoke less than 450) at thickness of 1”.
  - e. Room Corner Burn Test (NFPA 286). Material must meet Class A criteria at ¼” thickness as described by the 2003 International Building Code.
  - f. Extent of Burning (UL 94). Must submit UL card.
  - g. Impact strength. Minimum impact strength test as measured by ASTM D 3763 of 20 ft. lbs. (for durability, shipping, installation, and use).
  - h. Safety Glazing. Material must attain a Class A impact rating in accordance with ANSI Z97.1-2004 at 1/8” thickness.
  - i. UPITT Test for Combustion Product Toxicity: Product must be recorded as “not more toxic than wood”.
  - j. Dynamic environmental testing (ASTM standards D 5116 and D 6670). Panels must not have detectable VOC off-gassing agents and must be Greenguard™ Indoor Air Quality certified.

### **2.03 FABRICATION**

- A. General: Fabricate Plastic Fabrications to designs, sizes and thicknesses indicated and to comply with indicated standards. Sizes, profiles and other characteristics are indicated on the drawings.
- B. Comply with manufacturer’s written recommendations for fabrication.
- C. Machining: Acceptable means of machining are listed below. Ensure that material is not chipped or warped by machining operations.
  1. Sawing: Select equipment and blades suitable for type of cut required.
  2. Drilling: Drills specifically designed for use with plastic products.
  3. Milling: Climb cut where possible.
  4. Routing
  5. Tapping
- D. Forming: Form products to shapes indicated using the appropriate method listed below. Comply with manufacturer’s written instructions.
  1. Cold Bending
  2. Hot Bending
  3. Thermoforming: Acceptable only on uncoated material.
  4. Drape Forming
  5. Matched Mold Forming
  6. Mechanical Forming
- E. Suspension System : 3Form Suspend Solution
  1. Hardware: See manufacturer for information and accessories
- F. Laminating: Laminate to substrates indicated using adhesives and techniques recommended by manufacturer.



## **2.04 ACCESSORIES**

- A. Gaskets shall be as per manufacturer's standards to meet performance criteria at exterior canopies.
- B. Fasteners at exterior canopies shall be per manufacturer's standards to meet performance requirements.

## **2.05 MISCELLANEOUS MATERIALS**

- A. General: Provide products of material, size, and shape required for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaner: Type recommended by manufacturer.
- C. Fasteners: Use screws designed specifically for plastics. Self-threading screws are acceptable for permanent installations. Provide threaded metal inserts for applications requiring frequent disassembly such as light fixtures.
- D. Bonding Cements: May be achieved with solvents or adhesives, suitable for use with product and application.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions where installation of Plastic Fabrications will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for installation and comply with requirements specified.

### **3.02 INSTALLATION**

- A. General: Comply with manufacturer's written instructions for the installation of Plastic Fabrications.
- B. Manufacturer's shop to fabricate items to the greatest degree possible.
- C. Utilize fasteners, adhesives and bonding agents recommended by manufacturer for type of installation indicated. Material that is chipped, warped, hazed or discolored as a result of installation or fabrication methods will be rejected.
- D. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
- E. Form field joints using manufacturer's recommended procedures. Locate seams in panels so that they are not directly in line with seams in substrates.

### **3.03 CLEANING AND PROTECTION**

- A. Protect surfaces from damage until date of substantial completion. Repair work or replace damaged work, which cannot be repaired to Architect's satisfaction.

**END OF SECTION**

**SECTION 06 1000  
ROUGH CARPENTRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Furnish and install all structural plywood, blocking, supports, non-structural nailers, and stripping as required for securing other work, shown on Drawings. Furnish all hardware, miscellaneous rough carpentry and related accessories as indicated on the Drawings or specified herein for a complete installation.

**1.02 QUALITY ASSURANCE**

- A. Codes and Standards: All lumber shall conform to all requirements of the International Building Code. All framing lumber and plywood shall be appropriately grade marked with an agency certified by the American Lumber Standards Committee Board of Review for lumber or the American Plywood Association for plywood.
- B. Coordination: Contractor shall coordinate location of blocking with other related trades. Other Contractors will furnish exact locations of grounds and blockings to this Contractor for proper installation of their Work.

**1.03 SUBMITTALS**

- A. Product Data: Submit copies of manufacturer's product data indicating specifications and installation requirements for rough hardware items specified, i.e., connectors, joist hangers, etc.
- B. Letters: Submit letter of compliance that all lumber is grade-marked in compliance with specified products and that lumber is of species and fiber stress specified.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Lumber:
  - 1. Standard Grade Hem-Fir: Non-structural furring, concealed blocking and stripping, and miscellaneous nailers, grade marked with WWPA stamp.
- B. Framing Lumber:
  - 1. Studs, sills, plates, ledgers, stiffeners, bridging, etc. Size and spacing as indicated and as required, shall be:

Species: Spruce-Pine-Fir: Grade No. 2 or better

Fb =	875 psi
Ft =	450 psi
Fv =	70 psi
Fc =	425 psi perpendicular to grain
Fc =	725 psi parallel to grain
Ec =	1,300,000 psi

- 2. Wood members 2" to 4" thick, 5" and wider.

Species: Hem-Fir: Grade No. 1 or better

Fb =	1200 psi
Ft =	800 psi
Fv =	75 psi
Fc =	425 psi perpendicular to grain
Fc =	1050 psi parallel to grain
Ec =	1,500,000 psi

3. Beam and Stringers

Species: Hem-Fir: Grade No. 1 or Douglas Fir-Larch: Dense No. 2

Fb =	1050 psi
Ft =	525 psi
Fv =	70 psi
Fc =	405 psi perpendicular to grain
Fc =	750 psi parallel to grain
Ec =	1,300,000 psi

C. Plywood:

1. Floor Sheathing: APA Structural I, exterior 3/4" thick. Span rating not less than 48/24.

D. Fasteners:

1. Nails: Meeting the requirements of ASTM F1667
  - a. Common wire nails. Use galvanized box nails where rough carpentry is exposed to moisture.
  - b. Non-corrosive finish nails of either stainless steel, aluminum or high quality hot-dipped galvanized shall be used on all exposed decorative lumber and redwood flooring.
2. Bolts: ASTM A307-94 "Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength," galvanized for exterior connections. Use washers under all heads where in contact with wood, use washers under all nuts. Bolts shall meet the requirements of ANSI/ASME Standard B18.2.1.
3. Screws: In accordance with ANSI/ASME Standard B18.6.1.
4. Connectors, Joist Hangers, Anchors, etc.: Type and size to meet job conditions and as indicated on the Drawings, or as required, as manufactured by Simpson Co., San Leandro, California 94577 or acceptable substitution.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Provide and securely fasten wood nailing strips, plates, blocking, etc., at proper levels in stud partitions, to anchor all items which require use of wood blocking to fasten or support components and accessories, and as nailers used in conjunction with roofing membrane, sheet metal and flashing and roofing accessories.
- B. Workmanship and General Framing
  1. Selection of Lumber Pieces: Carefully select all members, selecting pieces so that knots and obvious defects will not interfere with placing bolts, nailing, or making connections. Lumber may be rejected by Architect, whether or not is has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.
  2. Shimming: Do not shim sills, joists, short studs, trimmers, headers, lintels, or other framing components.
  3. Framing: Set all horizontal or sloped members with crown up. Do not notch, bore, or cut members for pipes, ducts, conduits, or other reasons except as indicated on Drawings or approved by Architect.
  4. Bearings: Make all bearings full unless indicated otherwise. Finish all bearing surfaces on which structural members are resting to give sure and even support. Where framing members slope, cut or notch ends as required for uniform bearing surface.
  5. Blocking: Install all blocking required to support all items of finish and to cut off all concealed draft openings, both vertical and horizontal, between ceiling and floor areas. Fire stops shall be two (2) inches (nominal) thick, by full width of opening being blocked. Provide fire stop in accordance with the Uniform Building Code, Chapter 25.

6. Bridging: Cross bridging shall be of not less than two (2) inches by three (3) inches nominal wood or of metal cross bridging of equal strength. Space lines of bridging at eight (8) feet max.
7. Nailing:
  - a. All nailing shall be in accordance with the Contract Drawings.
  - b. For conditions not covered in the Contract Drawings, provide penetration into piece receiving the point of not less than 1/2 the length of the nail or spike.
  - c. Do all nailing without splitting wood. Pre-bore as required. Replace all split members at Contractor's expense.
8. Bolting: Drill holes 1/16 inch larger in diameter than bolts being used. Drill straight and true from one side only.
  - a. Bolt threads shall not bear on wood. Use washers under head and nut where both bear on wood. Use washers under all nuts.
9. Screws: Pre-bore holes in accordance with the National Design Specification for Wood Construction.

**END OF SECTION**

**SECTION 06 1600**  
**SHEATHING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Wall sheathing.
- B. Roof sheathing.
- C. Subflooring.
- D. Sheathing joint and penetration treatment.
- E. Related Requirements:
- F. Section 06 10 00 - Rough Carpentry for plywood backing panels.
- G. Section 07 25 00 - Weather Barriers for water-resistive barrier applied over wall sheathing.

**1.02 RELATED DOCUMENTS**

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

**1.03 ACTION SUBMITTALS**

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

**1.04 INFORMATIONAL SUBMITTALS**

- A. Evaluation Reports: For following products, from ICC-ES:
  - 1. Preservative-treated plywood.
  - 2. Foam-plastic sheathing.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

**PART 2 PRODUCTS**

**2.01 WOOD PANEL PRODUCTS**

- A. Emissions: Products shall meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Certified Wood: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
  - 1. Plywood.
  - 2. Oriented strand board.
  - 3. Hardboard underlayment.
- C. Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise indicated.

- D. Oriented Strand Board: DOC PS 2.
- E. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- F. Factory mark panels to indicate compliance with applicable standard.

## **2.02 PRESERVATIVE-TREATED PLYWOOD**

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat all plywood unless otherwise indicated. Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

## **2.03 WALL SHEATHING**

- A. Plywood Wall Sheathing: sheathing.
  - 1. Span Rating: as indicated on the drawings.
  - 2. Nominal Thickness: as indicated on the drawings.
- B. Oriented-Strand-Board Wall Sheathing: Exposure 1 sheathing.
  - 1. Span Rating: as indicated on the drawings.
  - 2. Nominal Thickness: as indicated on the drawings.

## **2.04 ROOF SHEATHING**

- A. Plywood Roof Sheathing: Exposure 1 sheathing.
  - 1. Span Rating: Not less than 32/16.
  - 2. Nominal Thickness: Not less than 15/32 inch.
- B. Oriented-Strand-Board Roof Sheathing: Exposure 1 sheathing.
  - 1. Span Rating: Not less than 32/16.
  - 2. Nominal Thickness: Not less than 15/32 inch (11.9 mm)

## **2.05 SUBFLOORING**

- A. Plywood Subflooring: Exposure 1 sheathing.
  - 1. Span Rating: Not less than 48/24.
  - 2. Nominal Thickness: Not less than 23/32 inch
- B. Oriented-Strand-Board Subflooring: Exposure 1
  - 1. Span Rating: Not less than 48/24.
  - 2. Nominal Thickness: Not less than 23/32 inch

## **2.06 FASTENERS**

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.

- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
  - 1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

## **2.07 MISCELLANEOUS MATERIALS**

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 or ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
  - 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## **PART 3 EXECUTION**

### **3.01 INSTALLATION, GENERAL**

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

### **3.02 WOOD STRUCTURAL PANEL INSTALLATION**

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Subflooring:
    - a. Glue and nail/screw to wood framing.
    - b. Screw to cold-formed metal framing.
    - c. Space panels 1/8 inch (3 mm) apart at edges and ends.
  - 2. Wall and Roof Sheathing:
    - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
    - b. Screw to cold-formed metal framing.
    - c. Space panels 1/8 inch (3 mm) apart at edges and ends.

**END OF SECTION**

**SECTION 06 1753**  
**SHOP-FABRICATED WOOD TRUSSES R1**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES:**

- A. Wood roof trusses.
- B. Wood floor trusses.
- C. Wood girder trusses.
- D. Wood truss bracing.
- E. Metal truss accessories.

**1.02 RELATED REQUIREMENTS:**

- A. Section 06 16 00 - Sheathing for roof sheathing and subflooring.
- B. Section 31 31 16 - Termite Control for site application of borate treatment to wood trusses.
- C. Allowances: Provide wood truss bracing under the Metal-Plate-Connected Truss Bracing Allowance as specified in Section 01 21 00 "Allowances."

**1.03 RELATED DOCUMENTS**

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

**1.04 DEFINITIONS**

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

**1.05 QUALITY ASSURANCE**

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
  - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
  - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

**1.06 ACTION SUBMITTALS**

- A. Product Data: For wood-preservative-treated lumber metal-plate connectors, metal truss accessories, and fasteners.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.
  - 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.



- B. Shop Drawings: Show fabrication and installation details for trusses.
  - 1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
  - 2. Indicate sizes, stress grades, and species of lumber.
  - 3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
  - 4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
  - 5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
  - 6. Show splice details and bearing details.
- C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer in the state of New Mexico responsible for their preparation.

### **1.07 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For metal connector-plate manufacturer professional engineer and fabricator.
- B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.
- C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.
- D. Evaluation Reports: For the following, from ICC-ES:
  - 1. Wood-preservative-treated lumber.
  - 2. Fire-retardant-treated wood.
  - 3. Metal-plate connectors.
  - 4. Metal truss accessories.

### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Handle and store trusses to comply with recommendations in TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
  - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
  - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
  - 3. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

## **PART 2 PRODUCTS**

### **2.01 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design metal-plate-connected wood trusses.
- B. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
  - 1. Design Loads: As indicated.
  - 2. Maximum Deflection Under Design Loads:
    - a. Roof Trusses: Vertical deflection of 1/360 of span.
    - b. Floor Trusses: Vertical deflection of 1/360 of span.

- C. Comply with applicable requirements and recommendations of the following publications:
  - 1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
  - 2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
  - 3. TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

## **2.02 DIMENSION LUMBER**

- A. Certified Wood: For metal-plate-connected wood trusses and permanent bracing, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
  - 3. Provide dressed lumber, S4S.
  - 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- C. Minimum Chord Size for Roof Trusses: 2 by 6 inches nominal for both top and bottom chords.
- D. Minimum Specific Gravity for Top Chords: 0.50.
- E. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 10 00 "Rough Carpentry".

## **2.03 WOOD-PRESERVATIVE-TREATED LUMBER**

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
  - 2. For exposed trusses indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
  - 1. For exposed trusses indicated to receive a stained or natural finish, mark end or back of each piece.

## **2.04 METAL CONNECTOR PLATES**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Alpine Engineered Products, Inc.; an ITW company.
  - 2. Cherokee Metal Products, Inc.; Masengill Machinery Company.
  - 3. CompuTrus, Inc.

4. Eagle Metal Products.
  5. Jager Building Systems, Inc.; a Tembec/SGF Rexfor company.
  6. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.
  7. Robbins Engineering, Inc.
  8. Truswal Systems Corporation; an ITW company.
- B. Source Limitations: Obtain metal connector plates from single manufacturer.
- C. General: Fabricate connector plates to comply with TPI 1.
- D. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch (0.9 mm) thick.
1. Use for interior locations unless otherwise indicated.
- E. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
1. Use for wood-preservative-treated lumber and where indicated.
- F. Stainless-Steel Sheet: ASTM A 666, Type 304 Type 316, and not less than 0.035 inch (0.88 mm) thick.
1. Use for exterior locations, wood-preservative-treated lumber, and where indicated.

## **2.05 FASTENERS**

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
  2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.

## **2.06 METAL FRAMING ANCHORS AND ACCESSORIES**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Cleveland Steel Specialty Co.
  2. KC Metals Products, Inc.
  3. Phoenix Metal Products, Inc.
  4. Simpson Strong-Tie Co., Inc.
  5. USP Structural Connectors.
- C. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- D. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
1. Use for interior locations unless otherwise indicated.

- E. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
  - 1. Use for wood-preservative-treated lumber and where indicated.
- F. Stainless-Steel Sheet: ASTM A 666, Type 304 or Type 316.
  - 1. Use for exterior locations and where indicated.
- G. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below, 1-1/2 inches (38 mm) wide by 0.050 inch (1.3 mm) thick. Tie fastens to one side of truss, top plates, and side of stud below.
- H. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/4 inches (57 mm) wide by 0.062 inch (1.6 mm) thick. Tie fits over top of truss and fastens to both sides of truss, top plates, and one side of stud below.
- I. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/2 inches (63 mm) wide by 0.062 inch (1.6 mm) thick. Tie fits over top of truss and fastens to both sides of truss, inside face of top plates, and both sides of stud below.
- J. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches (32 mm) wide by 0.050 inch (1.3 mm) thick. Clip is fastened to truss through slotted holes to allow for truss deflection.
- K. Floor Truss Hangers: U-shaped hangers, full depth of floor truss, with 1-3/4-inch- (44-mm-) long seat; formed from metal strap 0.062 inch (1.6 mm) thick with tabs bent to extend over and be fastened to supporting member.
- L. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches (38 mm) wide by 1 inch (25 mm) deep by 0.040 inch (1.0 mm) thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

## **2.07 MISCELLANEOUS MATERIALS**

- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.
- B. Protective Coatings: SSPC-Paint 22, epoxy-polyamide primer or SSPC-Paint 16, coal-tar epoxy-polyamide paint.

## **2.08 FABRICATION**

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
  - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

## **2.09 SOURCE QUALITY CONTROL**

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.
  - 1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.

2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.
- B. Correct deficiencies in Work that special inspections indicate does not comply with the Contract Documents.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
  1. Anchor trusses to girder trusses as indicated.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
  1. Install bracing to comply with Section 06 10 00 "Rough Carpentry."
  2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- L. Replace wood trusses that are damaged or do not meet requirements.
  1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

#### **3.02 REPAIRS AND PROTECTION**

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- D. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
  1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

**END OF SECTION**

**SECTION 06 4100**  
**ARCHITECTURAL WOOD CASEWORK**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Countertops.
- C. Hardware.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 12 3600 - Countertops.

**1.03 REFERENCE STANDARDS**

- A. AWI (QCP) - Quality Certification Program; Current Edition.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- D. BHMA A156.9 - Cabinet Hardware; 2020.
- E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
  - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
  - 2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

**1.06 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
  - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
  - 2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Quality Certification:
  - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: [www.awiqcp.org/#sle](http://www.awiqcp.org/#sle).
  - 2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
  - 3. Provide designated labels on shop drawings as required by certification program.
  - 4. Provide designated labels on installed products as required by certification program.

5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
6. Replace, repair, or rework all work for which certification is refused.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from moisture damage.

#### **1.08 FIELD CONDITIONS**

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

### **PART 2 PRODUCTS**

#### **2.01 CABINETS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.
- C. Cabinets:
  1. Cabinet Design Series: As indicated on drawings.
  2. Adjustable Shelf Loading: 40 psf.
  3. Cabinet Style: Flush overlay.
  4. Cabinet Doors and Drawer Fronts: Flush style.
  5. Drawer Side Construction: Multiple-dovetailed.
  6. Drawer Construction Technique: Dovetail joints.

#### **2.02 WOOD-BASED COMPONENTS**

- A. Wood fabricated from old growth timber is not permitted.

#### **2.03 LAMINATE MATERIALS**

- A. Manufacturers:
  1. Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
  2. Panolam Industries International, Inc: [www.panolam.com/#sle](http://www.panolam.com/#sle).
  3. Wilsonart LLC: [www.wilsonart.com/#sle](http://www.wilsonart.com/#sle).
- B. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.
- C. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- D. Provide specific types as indicated.
  1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, color as selected, finish as indicated.
  2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, color as selected, finish as indicated.
  3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, color as selected, finish as indicated.
  4. Cabinet Liner: CLS, 0.020 inch nominal thickness, color as selected, finish as indicated.
  5. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

#### **2.04 COUNTERTOPS**

- A. Countertops: See Section 12 3600.

#### **2.05 ACCESSORIES**

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.

## **2.06 HARDWARE**

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

## **2.07 FABRICATION**

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
  - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
  - 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

## **2.08 SHOP FINISHING**

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- C. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

### **3.02 ADJUSTING**

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

### **3.03 CLEANING**

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

**END OF SECTION**



**SECTION 06 8316**  
**FIBER REINFORCED PANELING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Glass fiber reinforced, resin fabrications for adhesive mounting.

**1.02 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- B. FM (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.
- C. ITS (DIR) - Directory of Listed Products; current edition.
- D. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- E. ASTM E 84- Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.
- F. AWI/AWMAC (QSI)- Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2003.
- G. NFPA 5000- Chapter 10, Interior Finishes.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified component products.
- C. Shop Drawings: Indicate design load parameters, dimensions, adjacent construction, materials, thicknesses, fabrication details, required clearances, field jointing, tolerances, colors, finishes, methods of support, integration of plumbing components, and anchorages.
- D. Samples: Submit two \_\_, 6x6 inch in size, illustrating color, texture, and finish.
- E. Maintenance Data: Include instructions for stain removal, surface and gloss restoration.

**1.04 QUALITY ASSURANCE**

- A. Designer Qualifications: Design under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in architectural glass fiber and resin components with three years documented experience.
- C. All finishes shall conform to NFPA 5000, Chapter 10 Finishes.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect components from damage by retaining shipping protection in place until installation.
- B. Store products in manufacturer's unopened packaging until ready for installation.

**1.06 FIELD CONDITIONS**

- A. Do not install site fabricated components when site conditions may be detrimental to successful installation.
- B. Maintain temperature and humidity conditions favorable to proper curing of resin during and after installation.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Basis of Design: Manufacturer- Marlite, [www.marlite.com](http://www.marlite.com); Standard FRP.
- B. Substitutions: See Section 01 6000- Product Requirements.

## **2.02 ACCESSORIES**

- A. General: Accessories recommended by composite trim manufacturer for complete installation.
- B. Adhesives: Type recommended by composite trim manufacturer for application; not containing formaldehyde or volatile organic compounds.
  - 1. Where visible in finished work, tint adhesive to match composite trim exposed surface.

## **2.03 PREFINISHED PANELS**

- A. Prefinished Panels:
  - 1. Thickness: 1/8 inch
  - 2. Size: 48 inches x 96 inches.
  - 3. Edges: Square
  - 4. Finish: Pebbled
  - 5. Color: White (P100).
  - 6. Trim: To suit panel configuration; PVC trim.
  - 7. Surface Burning Characteristics: Flame spread index of 25 or less, smoke development index of 450 or less, when tested in accordance with ASTM E 84 Class A/I.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify substrates are prepared to receive composite trim.
- B. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.
- C. Do not begin installation until substrate has been properly prepared.
- D. If substrate preparation is the responsibility of another installer, notify the General Contractor of unsatisfactory preparation before proceeding.
- E. Do not begin installation until building is completely enclosed and interior conditions are being maintained as intended during occupancy; approx. 70 degree F.

### **3.02 INSTALLATION**

- A. Install fabrications in accordance with shop drawings and fabricator's instructions.
- B. Use the adhesives recommended by the panel manufacturer unless prohibited by local regulations; obtain manufacturers approval of alternative adhesives.
- C. Avoid contamination of panel faces; clean as necessary and replace if not possible to repair to original condition.
- D. Protect installed products until completion of project.
- E. Touch-up, repair, or replace damaged products after Substantial Completion.

### **3.03 TOLERANCES**

- A. Maximum variation from true position: 1/4 inch.
- B. Maximum offset from true alignment: 1/8 inch.

### **3.04 CLEANING**

- A. Clean components of foreign material without damaging finished surface.
- B. Hand rub smooth surfaces with polishing cream.
- C. Clean fabrications in accordance with fabricator's instructions.

### **3.05 PROTECTION**

- A. Protect existing surfaces from damage due to installation.
- B. Protect installed products until completion of project.

**END OF SECTION**

**SECTION 07 2100  
THERMAL INSULATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Board insulation and integral vapor retarder at perimeter foundation wall and exterior wall behind exterior wall finish.
- B. Board Insulation above roof deck.
- C. Batt insulation and vapor retarder in exterior wall and roof construction.
- D. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.
- E. Acoustic batt insulation in interior walls and floor / ceiling space.

**1.02 RELATED REQUIREMENTS**

- A. Section 04 2616 - Adhered Masonry Veneer
- B. Section 07 2400 - Exterior Insulation and Finish Systems
- C. Section 07 2500 - Weather Barriers

**1.03 REFERENCE STANDARDS**

- A. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2019.
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.
- D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2022.
- E. ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics; 2016.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022.
- H. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C; 2019a.
- I. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2019.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.
- D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
- E. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- F. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of contractor accreditation and installer certification on project site during and after installation. Present on-site documentation upon request.

## 1.05 QUALITY ASSURANCE

- A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); [www.airbarrier.org/#sle](http://www.airbarrier.org/#sle):
  - 1. Installer Qualification: Use accredited contractors, certified installers, evaluated materials, and third-party field quality control audit.
  - 2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

## 1.06 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

## PART 2 PRODUCTS

### 2.01 APPLICATIONS

- A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- B. Insulation in Wood Framed Walls and Roof: Batt insulation with separate vapor retarder.
- C. Insulation in Wood Framed Ceiling Structure: Batt insulation with separate vapor retarder.
- D. Insulation Over Roof Deck: Polyisocyanurate board.

### 2.02 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Perimeter Foundation Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
  - 1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
  - 3. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
  - 4. Complies with fire resistance requirements indicated on drawings as part of an exterior load-bearing exterior wall assembly when tested in accordance with NFPA 285.
  - 5. Board Edges: Square.
  - 6. Type and Water Absorption: Type XII, 0.3 percent by volume, maximum, by total immersion.
  - 7. Products:
    - a. DuPont de Nemours, Inc; Styrofoam Brand \_\_\_\_: [building.dupont.com/#sle](http://building.dupont.com/#sle).
    - b. Kingspan Insulation LLC; GreenGuard XPS Type IV, 25 psi: [www.kingspan.com/#sle](http://www.kingspan.com/#sle).
    - c. Owens Corning Corporation; FOAMULAR Type \_\_\_\_ Extruded Polystyrene (XPS) Insulation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
    - d. Dow Chemical Company: [www.dow.com](http://www.dow.com).
    - e. Substitutions: See Section 01 6000 - Product Requirements.
- B. Extruded Polystyrene (XPS) Continuous Insulation (CI) Board: Comply with ASTM C578, and manufactured using carbon black technology.
  - 1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
  - 3. Type and Thermal Resistance, R-value: Type IV, 5.0, (\_\_\_\_), minimum, per 1 inch thickness at 75 degrees F mean temperature.
  - 4. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
  - 5. Board Size: 48 inch by 96 inch.
  - 6. Board Thickness: As required to meet R-value of wall assembly.
  - 7. Board Edges: Square, at long edges.
  - 8. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
  - 9. Products:

- a. DuPont de Nemours, Inc; Styrofoam Brand Ultra SL (Shiplap):  
building.dupont.com/#sle.
  - b. Owens Corning Corporation; FOAMULAR Type Extruded Polystyrene (XPS)  
Insulation: www.ocbuildingspec.com/#sle.
  - c. Dow Chemical Company: www.dow.com.
  - d. Substitutions: See Section 01 6000 - Product Requirements.
- C. Rigid Cellular Polyisocyanurate (ISO) Thermal Insulation Board above roof deck: Complying with ASTM C1289.
- 1. Classifications:
    - a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
      - 1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
      - 2) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
      - 3) Thermal Resistance, R-value: At 1-1/2 inch thick; Class 1, Grades 1-2-3 - 8.4 (1.48), minimum, at 75 degrees F.
  - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
  - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
  - 4. Board Size: 48 by 96 inch.
  - 5. Board Thickness: 3 inches minimum, 2 layers.
  - 6. Board Edges: Square.
  - 7. Water Vapor Permeance: 1.2 perm, maximum, at 1 inch thickness, and when tested in accordance with ASTM E96/E96M, desiccant method.
  - 8. Products:
    - a. Basis of design: Carlisle Coatings & Waterproofing, Inc; SecureShield:  
www.carlisleccw.com/#sle
    - b. DuPont de Nemours, Inc; Thermax Brand Insulation: building.dupont.com/#sle.
    - c. GAF; EnergyGuard Polyiso Insulation: www.gaf.com/#sle.
    - d. Johns Manville: www.jm.com/#sle

### 2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

- A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
- 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
  - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
  - 4. Formaldehyde Content: Zero.
  - 5. Thermal Resistance: R-value of 19.
  - 6. Facing: Aluminum foil, flame spread 25 rated; one side.
  - 7. Products:
    - a. CertainTeed Corporation; \_\_\_\_\_: www.certainteed.com/#sle.
    - b. Johns Manville; \_\_\_\_\_: www.jm.com/#sle.
    - c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation:  
www.ocbuildingspec.com/#sle.
    - d. Substitutions: See Section 01 6000 - Product Requirements.

### 2.04 ACCESSORIES

- A. Sheet Vapor Retarder: See Section 07 2600.
- B. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
- 1. Application: Sealing of interior circular penetrations, such as pipes or cables.
  - 2. Width: Are required for application.
- C. Flashing Tape: Special reinforced film with high performance adhesive.
- 1. Application: Window and door opening flashing tape.

2. Width: As required for application.
  3. Tape joints of rigid insulation in accordance with insulation manufacturers' instructions.
- D. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.
1. Width: 5-1/2 inches.
  2. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.
- E. Insulation Fasteners: Impaling clip of galvanized steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

### **3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER**

- A. Install boards horizontally on foundation perimeter.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.
  1. Install boards horizontally from base of foundation to top of insulation.
  2. Butt boards tightly, with joints staggered from insulation joints.

### **3.03 BOARD INSTALLATION AT EXTERIOR WALLS**

- A. Install boards horizontally on walls.
  1. Install in running bond pattern.
  2. Butt edges and ends tightly to adjacent boards and protrusions.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Place 6 inches wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.
- D. Tape insulation board joints.

### **3.04 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK**

- A. Board Installation Over Roof Deck, General:
  1. See applicable roofing specification section for specific board installation requirements.
  2. Ensure vapor retarder is clean and dry, continuous, and ready for application of roofing system.
  3. Fasten insulation to deck in accordance with roofing manufacturer's written instructions and applicable Factory Mutual requirements.
  4. Do not apply more insulation than can be covered with roofing on the same day.

### **3.05 BATT INSTALLATION**

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

- E. Install with factory-applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.
- F. Tape insulation batts in place.
- G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- H. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches on center. Lap and seal sheet retarder joints over face of member.
- I. Tape seal tears or cuts in vapor retarder.
- J. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.

### **3.06 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for additional requirements.

### **3.07 PROTECTION**

- A. Do not permit installed insulation to be damaged prior to its concealment.

**END OF SECTION**

**SECTION 07 2400**  
**EXTERIOR INSULATION AND FINISH SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Composite wall and soffit cladding of rigid insulation and reinforced finish coating, Class PB.
- B. Drainage and water-resistive barriers behind insulation board.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Sheathing on wood framing.
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Perimeter flashings.
- C. Section 07 9200 - Joint Sealants: Sealing joints between EIFS and adjacent construction and penetrations through EIFS.

**1.03 REFERENCE STANDARDS**

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.
- B. ASTM C297/C297M - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions; 2016.
- C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2019.
- D. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2022.
- E. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage; 2013 (Reapproved 2019).
- F. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2017.
- G. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity; 2015 (Reapproved 2020).
- H. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).
- K. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies; 2018.
- L. ASTM E2485/E2485M - Standard Test Method for Freeze/Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water Resistive Barrier Coatings; 2013 (Reapproved 2018).
- M. ASTM E2486/E2486M - Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS); 2022.
- N. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).
- O. ASTM G155 - Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials; 2021.
- P. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems; 2009, with Editorial Revision (2014).
- Q. ICC-ES AC235 - Acceptance Criteria for EIFS Clad Drainage Wall Assemblies; 2009, with Editorial Revision (2012).



- R. ISO 9001 - Quality management systems -- Requirements; 2015.
- S. NFPA 259 - Standard Test Method for Potential Heat of Building Materials; 2018.
- T. NFPA 268 - Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source; 2022.
- U. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2019.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.
- C. Shop Drawings: Indicate wall and soffit joint patterns, joint details, and molding profiles.
- D. Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.
- E. Verification Samples: Submit actual samples of selected coating on specified substrate, minimum 12 inches (300 mm) square, illustrating project colors and textures.
- F. Manufacturer's Installation Instructions: Indicate preparation required, installation techniques, and jointing requirements.

#### **1.05 QUALITY ASSURANCE**

- A. Maintain copy of specified installation standard and manufacturer's installation instructions at project site during installation.
- B. EIFS Manufacturer Qualifications: Provide EIFS products other than insulation from the same manufacturer with qualifications as follows:
  1. Member in good standing of EIMA (EIFS Industry Members Association).
  2. Manufacturer of EIFS products for not less than 5 years.
  3. Manufacturing facilities ISO 9001 certified.
- C. Insulation Manufacturer Qualifications: Approved by manufacturer of EIFS and approved and labeled under third party quality program as required by applicable building code.
- D. Installer Qualifications: Company specializing in the type of work specified and with at least three years of documented experience.

#### **1.06 MOCK-UPS**

- A. Construct mock-up of typical EIFS application on specified substrate, size as indicated on drawings, and including flashings, joints, and edge conditions.
- B. Locate mock-up as indicated on drawings.
- C. Mock-up may remain as part of the Work.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.
- B. Storage: Store materials as directed by manufacturer's written instructions.
  1. Protect adhesives and finish materials from freezing, temperatures below 40 degrees F (4 degrees C) and temperatures in excess of 90 degrees F (32 degrees C).
  2. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.
  3. Protect insulation materials from exposure to sunlight.

#### **1.08 FIELD CONDITIONS**

- A. Do not prepare materials or apply EIFS under conditions other than those described in the manufacturer's written instructions.

- B. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.
- C. Do not install coatings or sealants when ambient temperature is below 40 degrees F (5 degrees C).
- D. Do not leave installed insulation board exposed to sunlight for extended periods of time.

## **1.09 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide manufacturer's standard material warranty, covering a period of not less than 5 years.
- C. Provide separate warranty from installer covering labor for repairs or replacement for a period of not less than 5 years.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Basis of Design: Sto Corp; [www.stocorp.com](http://www.stocorp.com)
- B. Other Acceptable Manufacturers:
  1. Parex USA; [www.parex.com](http://www.parex.com)
  2. Dryvit Systems, Inc.; [www.dryvit.com](http://www.dryvit.com)

### **2.02 EXTERIOR INSULATION AND FINISH SYSTEM**

- A. Exterior Insulation and Finish System: DRAINAGE type; reinforced finish coating on flat-backed insulation board adhesive-applied directly to water-resistive coating over substrate; provide a complete system that has been tested to show compliance with the following characteristics; include all components of specified system and substrate(s) in tested samples.
- B. Fire Characteristics:
  1. Flammability: Pass, when tested in accordance with NFPA 285.
  2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.
  3. Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability (above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot (mJ/sq m).
- C. Adhesion of Water-Resistive Coating to Substrate: For each combination of coating and substrate, minimum flatwise tensile bond strength of 15 psi (105 kPa), when tested in accordance with ASTM C297/C297M.
- D. Adhesion to Water-Resistive Coating: For each combination of insulation board and substrate, when tested in accordance with ASTM C297/C297M, maximum adhesive failure of 25 percent unless flatwise tensile bond strength exceeds 15 psi (105 kPa) in all samples.
- E. Water Penetration Resistance: No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes, when tested in accordance with ASTM E331 at 6.24 psf (299 Pa) differential pressure with tracer dye in the water spray; include in tested sample at least two vertical joints and one horizontal joint of same type to be used in construction; disassemble sample if necessary to determine extent of water penetration.
- F. Drainage Efficiency: Average minimum efficiency of 90 percent, when tested in accordance with ASTM E2273 for 75 minutes.
- G. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ICC-ES AC219 or ICC-ES AC235.
- H. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G153 Cycle 1 or ASTM G155 Cycles 1, 5, or 9.

- I. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D2247.
- J. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D3273.
- K. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D968 with 113.5 gallons (500 liters) of sand.
- L. Impact Resistance: Construct system to provide the following impact resistance without exposure of broken reinforcing mesh, when tested in accordance with ASTM E2486/E2486M:
  - 1. Standard: 25 to 49 in-lb (2.83 to 5.54 J), for areas not indicated as requiring higher impact resistance.
  - 2. Medium: 50 to 89 in-lb (5.65 to 10.1 J), for areas indicated on drawings.
  - 3. High: 90 to 150 in-lb (10.2 to 17 J), for areas indicated on the drawings.

### **2.03 MATERIALS**

- A. Finish Coating Top Coat: Water-based, air curing, acrylic or polymer-based finish with integral color and texture.
  - 1. Texture: To be selected by Architect from mock-up samples as provided by Contractor.
  - 2. Color: As selected by Architect from manufacturer's custom range.
- B. Base Coat: Fiber-reinforced, acrylic or polymer-based product compatible with insulation board and reinforcing mesh, Class PB.
- C. Reinforcing Mesh: Balanced, open weave glass fiber fabric, treated for compatibility and improved bond with coating, weight, strength, and number of layers as required to meet required system impact rating.
- D. Expanded Polystyrene (EPS) Board Insulation: Complies with ASTM C578.
  - 1. Grooved Board: Back side of board adjacent to sheathing grooved with vertical channels designed to allow moisture to drain; at drainage points provide board configuration that permits drainage to the exterior.
  - 2. Board Size: 24 by 48 inches (610 by 1220 mm).
  - 3. Board Size Tolerance: Plus/minus 1/16 inch (1.5 mm) from square and dimension.
  - 4. Board Thickness: 2 inches at insulated steel framed walls and 3 inches at masonry walls.
  - 5. Board Edges: Square.
  - 6. Type and Thermal Resistance, R-value (RSI-value): Type XI, 3.1 (0.55) per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature using ASTM C177 test method.
  - 7. Type and Board Density: Type XI, 0.70 pcf (12 kg/cu m), minimum.
  - 8. Type and Compressive Resistance: Type XI, 5 psi (35 kPa), minimum.
  - 9. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, when tested in accordance with ASTM E84.
  - 10. Products:
    - a. StarRfoam; [www.starrfoam.com](http://www.starrfoam.com); ThermalStar Insulation Board 10.
- E. Water-Resistive Barrier Coating: Fluid-applied air and water barrier membrane; applied to sheathing; furnished or approved by EIFS manufacturer.

### **2.04 ACCESSORIES**

- A. Insulation Adhesive: Type required by EIFS manufacturer for project substrate.
- B. Insulation Fasteners: Fastener and plate system appropriate for substrate and as recommended by EIFS manufacturer.
- C. Trim: EIFS manufacturer's standard PVC or galvanized steel trim accessories, as required for a complete project and including starter track and drainage accessories.
- D. Sealant Materials: Compatible with EIFS materials and as recommended by EIFS manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate is sound and free of oil, dirt, other surface contaminants, efflorescence, loose materials, or protrusions that could interfere with EIFS installation and is of a type and construction that is acceptable to EIFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.
- B. If paper-faced gypsum sheathing has been exposed to weather for more than 30 days, check for integrity of surface using method specified in ASTM C1397 Annex A2, at minimum of two locations or once every 5000 sq ft (465 sq m), whichever is greater; if any test fails, notify Architect and do not begin installation.
- C. Verify that substrate surface is flat, with no deviation greater than 1/4 in (6 mm) when tested with a 10 ft (3 m) straightedge.

### **3.02 PREPARATION**

- A. Install self-furring metal lath over solid substrates that are deemed unacceptable to receive adhesively applied insulation. Install in accordance with ASTM C1063, except for butt-lapping instead of overlapping.
  - 1. Attach to concrete and concrete masonry using corrosion-resistant power or powder actuated fasteners or hardened concrete stub nails not less than 3/4 inch (19 mm) long and with heads not less than 3/8 inch (9.5 mm) wide. Ensure that fasteners are securely attached to substrate and spaced at maximum 16 inches (406 mm) on center horizontally and 7 inches (178 mm) vertically.
- B. Apply primer to substrate as recommended by EIFS manufacturer for project conditions.

### **3.03 INSTALLATION - GENERAL**

- A. Install in accordance with EIFS manufacturer's instructions and ASTM C1397.
  - 1. Where different requirements appear in either document, comply with the most stringent.
  - 2. Neither of these documents supercedes provisions of Contract Documents that defines contractual relationships between parties or scope of this work.

### **3.04 INSTALLATION - WATER-RESISTIVE BARRIER**

- A. Apply barrier coating as recommended by coating manufacturer; prime substrate as required before application.
- B. Seal substrate transitions and intersections with other materials to form continuous water-resistive barrier on exterior of sheathing, using method recommended by manufacturer.
- C. At door and window rough openings and other wall penetrations, seal water-resistive barrier and flexible flashings to rough opening before installation of metal flashings, sills, or frames, using method recommended by manufacturer.
- D. Lap flexible flashing or flashing tape at least 2 inches (50 mm) on each side of joint or transition.

### **3.05 INSTALLATION - INSULATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install back wrap reinforcing mesh at all openings and terminations that are not to be protected with trim.
- C. On wall surfaces, install boards horizontally. On horizontal surfaces, install boards \_\_\_\_\_.
- D. Place boards in a method to maximize tight joints. Stagger vertical joints and interlock at corners. Butt edges and ends tight to adjacent board and to protrusions. Achieve a continuous flush insulation surface, with no gaps in excess of 1/16 inch (1.6 mm).
- E. Fill gaps greater than 1/16 inch (1.6 mm) with strips or shims cut from the same insulation material.
- F. Rasp irregularities off surface of installed insulation board.

### **3.06 INSTALLATION - CLASS PB FINISH**

- A. Base Coat: Apply in thickness as necessary to fully embed reinforcing mesh, wrinkle free, including back-wrap at terminations of EIFS. Install reinforcing fabric as recommended by EIFS manufacturer.
  - 1. Lap reinforcing mesh edges and ends a minimum of 2-1/2 inches (64 mm).
  - 2. Allow base coat to dry a minimum of 24 hours before next coating application.
- B. At locations indicated, install second layer of reinforcing mesh embedded in second coat of base coating, tightly butting ends and edges of mesh.
- C. Install expansion joints at floor lines as recommended by EIFS manufacturer.
- D. Apply finish coat after base coat has dried not less than 24 hours, embed finish aggregate, and finish to a uniform texture and color.
- E. Finish Coat Thickness: As recommended by manufacturer.
- F. Seal control and expansion joints within the field of exterior finish and insulation system, using procedures recommended by sealant and finish system manufacturers.

### **3.07 CLEANING**

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

### **3.08 PROTECTION**

- A. Protect completed work from damage and soiling by subsequent work.

**END OF SECTION**

**SECTION 07 2500  
WEATHER BARRIERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air tight or vapor retardant.
- B. Vapor Retarders: Materials to make exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls water vapor resistant and air tight.
- C. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.
- B. Section 07 2100 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.
- C. Section 07 5400 - Thermoplastic Membrane Roofing: Vapor retarder installed as part of roofing system.

**1.03 DEFINITIONS**

- A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.
- C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
  - 1. Water Vapor Permeance: For purposes of conversion,  $57.2 \text{ ng}/(\text{Pa s sq m}) = 1 \text{ perm}$ .
- D. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

**1.04 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.
- C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022.
- D. ICC-ES AC308 - Acceptance Criteria for Water-Resistive Barriers; 2016, with Editorial Revision (2019).

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on material characteristics.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

**1.06 QUALITY ASSURANCE**

- A. Air Barrier Association of America (ABAA) Evaluated Materials Program (EAP); [www.airbarrier.org/#sle](http://www.airbarrier.org/#sle): Use evaluated materials from a single manufacturer regularly engaged

in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

## **PART 2 PRODUCTS**

### **2.01 WEATHER BARRIER ASSEMBLIES**

- A. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.
  - 1. Use building paper unless otherwise indicated.
  - 2. Under Portland cement stucco, use two separate layers of building paper.
  - 3. Under siding, use two separate layers of building paper.
- B. Exterior Vapor Retarder:
  - 1. On outside surface of inside wythe of masonry cavity wall use vapor retarder coating.
  - 2. On outside surface of sheathing use vapor retarder coating.

### **2.02 WATER-RESISTIVE BARRIER MATERIALS (NEITHER AIR BARRIER OR VAPOR RETARDER)**

- A. Building Paper: Asphalt-saturated Kraft building paper complying with requirements of ICC-ES AC308 Grade D.

### **2.03 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)**

- A. Vapor Retarder Coating: Liquid applied, resilient, UV-resistant coating and associated joint treatment.
  - 1. Water Vapor Permeance: 1.0 perm, maximum, when tested in accordance with ASTM E96/E96M.
  - 2. VOC Content: Less than 50 g per L when tested in accordance with 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Suitable for use on concrete, masonry, plywood and gypsum sheathing.
  - 4. Joint Preparation Treatment: Coating manufacturer's recommended method, either tape or reinforcing mesh saturated with coating material.
  - 5. Joint Filler: As recommended by coating manufacturer and suitable to the substrate.

### **2.04 ACCESSORIES**

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
  - 1. Width: 4 inches.
- C. Liquid Flashing: One part, fast curing, non-sag, elastomeric, gun grade, trowelable liquid flashing.
- D. Liquid Flashing: One part, fast curing, non-sag, gun grade, trowelable liquid flashing.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and conditions are ready to accept the work of this section.

### **3.02 PREPARATION**

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

### **3.03 INSTALLATION**

- A. Install materials in accordance with manufacturer's instructions.
- B. Water-Resistive Barriers: Install continuous barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.

- C. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- D. Mechanically Fastened Sheets - On Exterior:
  - 1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
  - 2. Overlap seams as recommended by manufacturer but at least 6 inches.
  - 3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
  - 4. Install water-resistive barrier over jamb flashings.
  - 5. Install air barrier and vapor retarder underneath the jamb flashings.
  - 6. Install head flashings under weather barrier.
  - 7. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.
- E. Coatings:
  - 1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
  - 2. Use flashing to seal to adjacent construction and to bridge joints.
- F. Openings and Penetrations in Exterior Weather Barriers:
  - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
  - 2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
  - 3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
  - 4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
  - 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
  - 6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

### **3.04 PROTECTION**

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

**END OF SECTION**



**SECTION 07 2600**  
**UNDER-SLAB VAPOR RETARDER**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Products Supplied Under This Section
- B. Vapor Retarder, seam tape, mastic, pipe boots for installation under concrete slabs.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-place Concrete
- B. Section 03 20 00 - Concrete Forming and Accessories
- C. Section 31 23 11 - Earthwork for Building Construction

**1.03 REFERENCES**

- A. American Society for Testing and Materials (ASTM), latest versions:
  - 1. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials
  - 2. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
  - 3. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
  - 4. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
- B. American Concrete Institute (ACI), latest versions:
  - 1. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials

**1.04 SUBMITTALS**

- A. Quality Control / Assurance
  - 1. Comply with Section 01 33 00 – Submittal Procedures.
  - 2. Independent laboratory test results showing compliance with ASTM & ACI Standards.
  - 3. Manufacturer's samples, literature
  - 4. Manufacturer's installation instructions for placement, seaming and pipe boot installation.
- B. Delivery, Storage, and Handling
  - 1. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
  - 2. Store materials in a clean dry area in accordance with manufacturer's instructions.
  - 3. Stack membrane on smooth ground or wood platform to eliminate warping.
  - 4. Protect materials during handling and application to prevent damage or contamination.
  - 5. Ensure membrane is stamped with manufacturer's name, product name and membrane thickness at intervals of no more than 85" (220 cm).
- C. Environmental requirements
  - 1. Product not intended for uses subject to abuse or permanent exposure to the elements.
  - 2. Do not apply on frozen ground.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Vapor Retarder (Performance-Based Specifications)
  - 1. Vapor Retarder must have the following qualities at minimum and meet floor finish manufacturer's warranty requirements.
    - a. Water Vapor Retarder ASTM E1745: Meets or exceeds Class A
    - b. Maximum Permeance ASTM E96: 0.01 Perms or as required to meet Flooring Manufacturer's Warranties.
    - c. Tensile Strength ASTM E154, Section 9: not less than 45 LBS. Force/Inch
    - d. Puncture Resistance, ASTM D1709, Method B.
    - e. Thickness of Retarder (plastic) ACI 302.1R: Not less than 15 mils
    - f. Material: Virgin Polyethylene or Polyolefin
  - 2. Vapor Retarder Products may be by one of the following manufacturers or an approved equal, as long as the requirements above are met.
    - a. Epro, <http://eproserv.com>
    - b. Fortifiber, <http://www.fortifiber.com>
    - c. Stego Industries, <http://www.stegoindustries.com>
    - d. W.R. Meadows, <http://www.wrmeadows.com>
    - e. Raven Industries, <http://www.vaporblock.com>
    - f. Reef Industries, <http://www.reefindustries.com>
    - g. Insulation Solutions, <http://www.insulationsolution.com>

### **2.02 ACCESSORIES**

- A. Seam Tape
  - 1. Tape must have the following qualities:
    - a. Water Vapor Transmission Rate ASTM E 96 0.3 perms or lower
- B. Vapor Proofing Mastic
  - 1. Mastic must have the following qualities:
    - a. Water Vapor Transmission Rate ASTM E 96 0.3 perms or lower
- C. Pipe Boots
  - 1. Construct pipe boots from vapor Retarder material, pressure sensitive tape and/or mastic per manufacturer's instructions.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine surfaces to receive membrane. Ensure compaction requirements have been completed and geotechnical firm has confirmed compaction requirements have been met. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

### **3.02 SURFACE PREPARATION**

- A. Prepare surfaces in accordance with manufacturer's instructions.

### **3.03 INSTALLATION**

- A. Install Vapor Retarder:
  - 1. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643.
    - a. Unroll Vapor Retarder with the longest dimension parallel with the direction of the pour.
    - b. Lap Vapor Retarder over footings and seal to foundation walls.
    - c. Overlap joints 6 inches and seal with manufacturer's tape.
    - d. Seal all penetrations (including pipes) per manufacturer's instructions.
    - e. No penetration of the Vapor Retarder is allowed except for reinforcing steel and permanent utilities.

- f. Repair damaged areas by cutting patches of Vapor Retarder, overlapping damaged area 6 inches, and taping all four sides with tape.

**END OF SECTION**

**SECTION 07 5400**  
**THERMOPLASTIC MEMBRANE ROOFING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Adhered system with thermoplastic roofing membrane.
- B. Insulation, flat and tapered.
- C. Vapor retarder.
- D. Deck sheathing.
- E. Cover boards.
- F. Flashings.
- G. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 3100 - Steel Decking: Placement of acoustical insulation for deck flutes.
- B. Section 06 1000 - Rough Carpentry: Wood nailers and curbs.
- C. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashings and reglets.
- D. Section 07 7100 - Roof Specialties: Prefabricated roofing expansion joint flashing.
- E. Section 07 7200 - Roof Accessories: Roof-mounted units; prefabricated curbs.

**1.03 REFERENCE STANDARDS**

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2022.
- D. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing; 2021.
- E. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing; 2021.
- F. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2011 (Reapproved 2019).
- G. FM DS 1-28 - Wind Design; 2016.
- H. NRCA (RM) - The NRCA Roofing Manual; 2022.
- I. NRCA (WM) - The NRCA Waterproofing Manual; 2021.
- J. UL (FRD) - Fire Resistance Directory; Current Edition.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week before starting work of this section.
  - 1. Review preparation and installation procedures and coordinating and scheduling required with related work.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
- C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.

- D. Samples for Verification: Submit two samples 4 by 4 inches (102 by 102 mm) in size illustrating colored coating.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- G. Manufacturer's qualification statement.
- H. Installer's qualification statement.
- I. Specimen Warranty: For approval.
- J. Warranty Documentation:
  1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
  2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum 20 years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this section with at least 5 years of documented experience and approved by manufacturer.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.
- B. Store materials in weather protected environment, clear of ground and moisture.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- D. Protect foam insulation from direct exposure to sunlight.

#### **1.08 FIELD CONDITIONS**

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C).
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

#### **1.09 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
  1. Warranty Term: 20 years.
  2. For repair and replacement include costs of both material and labor in warranty.
- C. Installer's Warranty: For repair and replacement include costs of both material and labor in warranty.
- D. Applicator's Warranty: Signed by installing applicator, covering the work of a System Warranty, including all components of roofing system installation such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, vapor retarders, and walkway products, for the following warranty period: 5 years from date of substantial completion.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:
  - 1. Carlisle SynTec Systems; Sure-Weld TPO: [www.carlisle-syntec.com/#sle](http://www.carlisle-syntec.com/#sle).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation:
  - 1. BASF Corporation; BASF Neopor GPS: [www.neopor.basf.us/#sle](http://www.neopor.basf.us/#sle).
  - 2. Carlisle SynTec Systems; SecurShield Insulation: [www.carlisle-syntec.com/#sle](http://www.carlisle-syntec.com/#sle).
  - 3. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 ROOFING - UNBALLASTED APPLICATIONS**

- A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over insulation.
- B. Roofing Assembly Requirements:
  - 1. Solar Reflectance Index (SRI): Minimum of 64 based on three-year aged value; if three-year aged data is not available, minimum of 82 initial value.
    - a. Calculate SRI in accordance with ASTM E1980.
    - b. Field applied coating may not be used to achieve specified SRI.
  - 2. Roof Covering External Fire Resistance Classification: UL (FRD) Class A.
  - 3. Factory Mutual Classification: Class 1 and windstorm resistance of 1-90, in accordance with FM DS 1-28.
  - 4. Insulation Thermal Resistance (R-Value): 3 per inch, minimum; provide insulation of thickness required.
- C. Acceptable Insulation Types - Constant Thickness Application:
  - 1. Minimum 2 layers of polyisocyanurate board.
- D. Acceptable Insulation Types - Tapered Application:
  - 1. Tapered polyisocyanurate board.

### **2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS**

- A. Membrane Roofing Materials:
  - 1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrim.
    - a. Thickness: 80 mil, 0.080 inch (2.0 mm), minimum.
  - 2. Sheet Width:
    - a. Adhered Application: Limit width to 120 inches (3,048 mm), maximum, when ambient temperatures are less than 40 degrees F (4.4 degrees C) for extended period of time during installation.
  - 3. Color: Gray.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Flexible Flashing Material: Same material as membrane.

### **2.04 DECK SHEATHING**

- A. Deck Sheathing: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
  - 1. Thickness: 1/2 inch (12.7 mm), fire-resistant.
  - 2. Products:
    - a. Georgia-Pacific; DensDeck Prime with EONIC Technology: [www.densdeck.com/#sle](http://www.densdeck.com/#sle).

### **2.05 COVER BOARDS**

- A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
  - 1. Thickness: 1/2 inch (12.7 mm), fire-resistant.
  - 2. Products:
    - a. Georgia-Pacific; DensDeck Prime with EONIC Technology: [www.densdeck.com/#sle](http://www.densdeck.com/#sle).

## 26 INSULATION

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
  - 1. Classifications:
    - a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
      - 1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
      - 2) Compressive Strength: Classes 1-2-3, Grade 2, 20 psi (138 kPa), minimum.
      - 3) Thermal Resistance, R-value (RSI-value): At 1-1/2 inches (38 mm) thick; Class 1, Grades 1-2-3, 8.4 (1.48), minimum, at 75 degrees F (24 degrees C).
  - 2. Board Size: 48 by 96 inches (1220 by 2440 mm).
  - 3. Board Thickness: 3 inches minimum, 2 layers
  - 4. Tapered Board: Slope as indicated; minimum thickness \_\_\_\_\_ inch (\_\_\_\_\_ mm); fabricate of fewest layers possible.
  - 5. Board Edges: Square.
  - 6. Products:
    - a. Carlisle SecurShield.

## 27 ACCESSORIES

- A. Prefabricated Roofing Expansion Joint Flashing: Sheet butyl over closed-cell foam backing seamed to galvanized steel flanges.
- B. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- C. Sheathing Joint Tape: Paper type, 6 inches (\_\_\_\_\_ mm) wide, self adhering.
- D. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
  - 1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.
- E. Membrane Adhesive: As recommended by membrane manufacturer.
- F. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
- G. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.
- H. Insulation Adhesive: As recommended by insulation manufacturer.
- I. Strip Reglet Devices: Galvanized steel, maximum possible lengths per location, with attachment flanges.
- J. Insulation Perimeter Restraint: Stainless steel edge device configured to restrain insulation boards in position and provide top flashing over ballast.
- K. Sealants: As recommended by membrane manufacturer.
- L. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
  - 1. Composition: Asphaltic with mineral granule surface.
  - 2. Size: 18 by 18 inches (460 by 460 mm).
  - 3. Surface Color: White or Yellow.
  - 4. Products:
    - a. W.R. Meadows, Inc; Whitewalk: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.

- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

### **3.02 PREPARATION - METAL DECK**

- A. Install preformed acoustical glass fiber insulation strips in roof deck flutes in accordance with manufacturer's instructions; see steel decking section.
- B. Do not begin installation of roof insulation over metal deck until welds have been cleaned and painted as specified under steel decking section.
- C. Install deck sheathing on metal deck:
  - 1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
  - 2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
  - 3. Tape joints.

### **3.03 INSTALLATION, GENERAL**

- A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.
- B. Do not apply roofing membrane during cold or wet weather conditions.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

### **3.04 INSTALLATION - MEMBRANE**

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive to substrate at rate of []. Fully embed membrane in adhesive except in areas directly over or within 3 inches (76 mm) of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches (76 mm). Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- E. At intersections with vertical surfaces:
  - 1. Extend membrane over cant strips and up a minimum of 4 inches (102 mm) onto vertical surfaces.
  - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
- F. Around roof penetrations, seal flanges and flashings with flexible flashing.
- G. Install roofing expansion joints where indicated. Make joints watertight.
  - 1. Install prefabricated joint components in accordance with manufacturer's instructions.
- H. Coordinate installation of roof drains and sumps and related flashings.

### **3.05 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.



### **3.06 CLEANING**

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Remove bituminous markings from finished surfaces.
- C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

### **3.07 PROTECTION**

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

**END OF SECTION**

**SECTION 07 6200**  
**SHEET METAL FLASHING AND TRIM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings, counterflashings, downspouts, and exterior penetrations.
- B. Sealants for joints within sheet metal fabrications.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 7123 - Manufactured Gutters and Downspouts.
- B. Section 07 7200 - Roof Accessories: Manufactured metal roof curbs.
- C. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2020.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- C. ASTM B32 - Standard Specification for Solder Metal; 2020.
- D. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2020.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).
- G. CDA A4050 - Copper in Architecture - Handbook; current edition.
- H. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week before starting work of this section.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

**1.06 QUALITY ASSURANCE**

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Sheet Metal Flashing and Trim:

1. ALUCOBOND by 3A Composites USA; ALUCOBOND AXCENT: [www.alucobondusa.com/#sle](http://www.alucobondusa.com/#sle).
  2. Fairview Architectural LLC: [www.fairview-na.com/#sle](http://www.fairview-na.com/#sle).
  3. OMG Roofing Products: [www.omgroofing.com/#sle](http://www.omgroofing.com/#sle).
  4. Petersen Aluminum Corporation: [www.pac-clad.com/#sle](http://www.pac-clad.com/#sle).
  5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Exterior Penetration Flashing Panel:
1. Quickflash Weatherproofing Products, Inc: [www.quickflashproducts.com/#sle](http://www.quickflashproducts.com/#sle).
  2. Substitutions: See Section 01 6000 - Product Requirements.

## 2.02 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal.
- B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal, shop pre-coated with PVDF coating.
  1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
  2. Color: As selected by Architect from manufacturer's full colors.
- C. Lead Sheet: ASTM B749, 0.047-inch minimum thickness; UNS Number L51121.

## 2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

## 2.04 GUTTERS AND DOWNSPOUTS

- A. See Section 07 7123 for manufactured gutters and downspouts.
- B. Downspouts: Rectangular profile.
- C. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3,000 psi at 28 days, with minimum 5 percent air entrainment.
- D. Seal metal joints.

## 2.05 EXTERIOR PENETRATION FLASHING PANELS

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

## 2.06 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer Type: Zinc chromate.
- C. Protective Backing Paint: Zinc molybdate alkyd.
- D. Concealed Sealants: Non-curing butyl sealant.
- E. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- F. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.
- G. Reglets: Surface-mounted type, galvanized steel; face and ends covered with plastic tape.
- H. Solder: ASTM B32, Alloy Grade - Sn50 (50/50).

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

### **3.02 PREPARATION**

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

### **3.03 INSTALLATION**

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Solder metal joints for full metal surface contact, and after soldering wash metal clean with neutralizing solution and rinse with water.
- E. Secure gutters and downspouts in place with concealed fasteners.
- F. Set splash pads under downspouts.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

**END OF SECTION**

**SECTION 07 7100  
ROOF SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Manufactured roof specialties, including copings and fascias.
- B. Roof control and expansion joint covers.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 7200 - Roof Accessories: Manufactured curbs and roof hatches.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2020.
- B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2017.
- C. NRCA (RM) - The NRCA Roofing Manual; 2022.
- D. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- D. Samples: Submit two appropriately sized samples of coping.
- E. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Roof Edge Flashings and Copings:
  - 1. Architectural Products Co; AP Standard Fascia: [www.archprod.com/#sle](http://www.archprod.com/#sle).
  - 2. BASIS OF DESIGN (roof edge flashing): ATAS International, Inc; Drip Edge Fascia: [www.atas.com/#sle](http://www.atas.com/#sle).
  - 3. Metal-Era Inc: [www.metalera.com/#sle](http://www.metalera.com/#sle).
  - 4. W.P. Hickman Company; Safeguard NP: [www.wph.com](http://www.wph.com).
  - 5. PAC Clad by Peterson; PAC Snap Edge Fascia: [www.pac-clad.com](http://www.pac-clad.com).
  - 6. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 COMPONENTS**

- A. Roof Edge Flashings: Factory fabricated to sizes required; corners mitered and welded; concealed fasteners.
  - 1. Configuration: Fascia, water dam, retainer, and edge securement for roof membrane.
  - 2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
  - 3. Fascia Material: Formed steel sheet, galvanized, 22 gauge, 0,03 inch thick, minimum.
  - 4. Finish: 70 percent polyvinylidene fluoride.
  - 5. Color: To be selected by Architect from manufacturer's full range.
- B. Copings: Factory fabricated to sizes required; corners mitered and welded; concealed fasteners.

1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness, and finish as cap; concealed stainless steel fasteners.
2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
3. Material: Formed steel sheet, galvanized, 24 gauge, 0.024 inch thick, minimum.
4. Finish: 70 percent polyvinylidene fluoride.
5. Color: To be selected by Architect from manufacturer's full range.

### **2.03 FINISHES**

- A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

### **2.04 ACCESSORIES**

- A. Sealant for Joints in Linear Components: As recommended by component manufacturer.
- B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.
  1. See Section 07 7200 for information on roofing related accessories.

### **3.02 INSTALLATION**

- A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Seal joints within components when required by component manufacturer.
- C. Anchor components securely.
- D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.
- E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.
- F. Coordinate installation of flashing flanges into reglets.

**END OF SECTION**

**SECTION 07 7123**  
**MANUFACTURED GUTTERS AND DOWNSPOUTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Pre-finished galvanized steel scuppers and downspouts.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 6200 - Sheet Metal Flashing and Trim.

**1.03 REFERENCE STANDARDS**

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021.
- C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021, with Errata (2022).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Comply with SMACNA (ASMM) for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.
- B. Comply with applicable code for size and method of rain water discharge.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on prefabricated components.
- C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
- D. Samples: Submit two samples, 4 inch long illustrating component design, finish, color, and configuration.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.
- B. Prevent contact with materials that could cause discoloration, staining, or damage.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Gutters and Downspouts:
  - 1. Alside, Inc; \_\_\_\_\_: [www.alside.com/#sle](http://www.alside.com/#sle).
  - 2. ATAS International, Inc; \_\_\_\_\_: [www.atas.com/#sle](http://www.atas.com/#sle).
  - 3. Hickman Edge Systems; \_\_\_\_\_: [www.hickmanedgesystems.com/#sle](http://www.hickmanedgesystems.com/#sle).
  - 4. SAF Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc; \_\_\_\_\_: [www.saf.com/persys/#sle](http://www.saf.com/persys/#sle).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Scupper and Collectors:
  - 1. ATAS International, Inc; \_\_\_\_\_: [www.atas.com/#sle](http://www.atas.com/#sle).
  - 2. Hickman Edge Systems. [www.hickmanedgesystems.com/#sle](http://www.hickmanedgesystems.com/#sle)
  - 3. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 MATERIALS**

- A. Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal.
- B. Pre-Finished Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal.
  - 1. Finish: Shop pre-coated with modified silicone coating.
  - 2. Color: As indicated.

## **2.03 COMPONENTS**

- A. Downspouts: CDA rectangular profile.
- B. Anchors and Supports: Profiled to suit gutters and downspouts.
  - 1. Anchoring Devices: In accordance with CDA requirements.
  - 2. Downspout Supports: Brackets.
- C. Fasteners: Galvanized steel, with soft neoprene washers.

## **2.04 FABRICATION**

- A. Form scuppers and downspouts of profiles and size indicated.
- B. Fabricate with required connection pieces.
- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Hem exposed edges of metal.
- E. Fabricate scupper and downspout accessories; seal watertight.

## **2.05 FINISHES**

- A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604, multiple coat, thermally cured fluoropolymer finish system; color as indicated.
- B. Primer Coat: Finish concealed side of metal sheets with primer compatible with finish system, as recommended by finish system manufacturer.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal scuppers to downspouts and accessories.

**END OF SECTION**



**SECTION 07 7200  
ROOF ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Roof curbs.
- B. Equipment rails.
- C. Roof penetrations mounting curbs.
- D. Roof hatches.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 6200 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
  - 1. Preparation instructions and recommendations.
  - 2. Installation methods.
  - 3. Maintenance requirements.
- C. Warranty Documentation:
  - 1. Submit manufacturer warranty.
  - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

**1.05 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

**PART 2 PRODUCTS**

**2.01 ROOF CURBS**

- A. Roof Curbs Manufacturers:
  - 1. AES Industries Inc.: [www.aescurb.com](http://www.aescurb.com).
  - 2. The Pate Company: [www.patecurbs.com](http://www.patecurbs.com).
  - 3. Roof Products & Systems (RPS): [www.rpscurbs.com](http://www.rpscurbs.com).
- B. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
  - 1. Roof Curb Mounting Substrate: Curb substrate consists of standing seam metal roof panel system.
  - 2. Sheet Metal Material:
    - a. Aluminum: 0.080 inch (2.03 mm) minimum thickness, with 3003 alloy, and H14 temper.
  - 3. Fabricate curb bottom and mounting flanges for installation directly on metal roof panel system to match slope and configuration of system.
    - a. Extend side flange to next adjacent roof panel seam and comply with seam configurations and seal connection, providing at least 6 inch (152 mm) clearance between curb and metal roof panel flange allowing water to properly flow past curb.

- b. Where side of curb aligns with metal roof panel flange, attach fasteners on upper slope of flange to curb connection allowing water to flow past below fasteners, and seal connection.
- c. Maintain at least 12 inch (305 mm) clearance from curb, and lap upper curb flange on underside of down sloping metal roof panel, and seal connection.
- d. Lap lower curb flange overtop of down sloping metal roof panel and seal connection.
- 4. Provide layouts and configurations indicated on drawings.
- C. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.
  - 1. Provide preservative treated wood nailers along top of curb.
  - 2. Insulate inside curbs with 1-1/2 inch (38 mm) thick fiberglass insulation.
  - 3. Height Above Finished Roof Surface: 8 inches (203 mm), minimum.
- D. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
- E. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches (400 mm) square unless otherwise indicated.
  - 1. Provide sliding channel welded along top edge with adjustable height steel bracket, fabricated to fit item supported.

## 2.02 ROOF HATCHES

- A. Roof Hatch Manufacturers:
  - 1. Acudor Products Inc; Galvanized Steel Roof Hatch: [www.acudor.com/#sle](http://www.acudor.com/#sle).
  - 2. Babcock-Davis; ThermalMAX: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
  - 3. Bilco Company; Type TB (various types and special size): [www.bilco.com/#sle](http://www.bilco.com/#sle).
  - 4. Dur-Red Products: [www.dur-red.com](http://www.dur-red.com).
  - 5. Milcor, Inc: [www.milcorinc.com](http://www.milcorinc.com).
  - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
  - 1. Insulation: Manufacturer's standard; 1 inch (25 mm) rigid glass fiber, located on outside face of curb.
  - 2. Curb Height: 12 inches (305 mm) from finished surface of roof, minimum.
- C. Metal Covers: Flush, insulated, hollow metal construction.
  - 1. Capable of supporting 40 psf (1.92 kPa) live load.
  - 2. Insulation: Manufacturer's standard 1 inch (25 mm) rigid glass fiber.
  - 3. Gasket: Neoprene, continuous around cover perimeter.
- D. Safety Railing System: Roof hatch safety rail system mounted directly to curb without penetration of roofing system.
  - 1. Railing Size: As indicated on drawings.
  - 2. Railing: Comply with 29 CFR 1910.23 for ladder safety, with a safety factor of two.
  - 3. Posts and Rails: Galvanized steel tubing.
  - 4. Gate: Same material as railing; automatic closing with latch.
  - 5. Finish: Manufacturer's standard, factory applied finish.
- E. Extendable Ladder Safety Post: Manufacturer's standard safety post mounted to roof ladder.
  - 1. Spring counter weight for easy lift with one hand.
  - 2. Provide latch to maintain the post at variable heights and to easily release for retracting the pole.
  - 3. Square post with non slip grip and a ring at top for a harness attachment.
  - 4. Color to be Safety Yellow.
- F. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.

1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf (475 kPa) load.
2. Hinges: Heavy duty pintle type.
3. Hold open arm with vinyl-coated handle for manual release.
4. Latch: Upon closing, engage latch automatically and reset manual release.
5. Manual Release: Pull handle on interior.
6. Locking: Padlock hasp on interior.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

#### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

#### **3.04 CLEANING**

- A. Clean installed work to like-new condition.

#### **3.05 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**SECTION 07 8400**  
**FIRESTOPPING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 01 7000 - Execution and Closeout Requirements: Cutting and patching.
- C. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

**1.03 REFERENCE STANDARDS**

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).
- D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.
- E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.
- F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2020.
- G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013 (Reapproved 2017).
- H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- I. ITS (DIR) - Directory of Listed Products; current edition.
- J. FM 4991 - Firestop Contractors; 2013.
- K. FM (AG) - FM Approval Guide; current edition.
- L. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2017).
- M. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
- N. UL (FRD) - Fire Resistance Directory; Current Edition.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Sustainable Design Submittal: Submit VOC content documentation for nonpreformed materials.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's qualification statement.

- G. Installer's qualification statement.

### **1.05 QUALITY ASSURANCE**

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
  - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
  - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at [www.icc-es.org](http://www.icc-es.org) will be considered as constituting an acceptable test report.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
  - 1. Trained by manufacturer.
  - 2. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
  - 3. Verification of minimum three years documented experience installing work of this type.
  - 4. Verification of at least five satisfactorily completed projects of comparable size and type.
  - 5. Licensed by local authorities having jurisdiction (AHJ).

### **1.06 MOCK-UPS**

- A. Install one firestopping assembly representative of each fire rating design required on project.
  - 1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
- B. If accepted, mock-up will represent minimum standard for this work.
- C. If accepted, mock-up may remain as part of this work. Remove and replace mock-ups not accepted.

### **1.07 FIELD CONDITIONS**

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Firestopping Manufacturers:
  - 1. 3M Fire Protection Products: [www.3m.com/firestop/#sle](http://www.3m.com/firestop/#sle).
  - 2. A/D Fire Protection Systems Inc: [www.adfire.com/#sle](http://www.adfire.com/#sle).
  - 3. Hilti, Inc: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 MATERIALS**

- A. Firestopping Materials: Any materials meeting requirements.
- B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.
- C. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- E. Fire Ratings: Refer to drawings for required systems and ratings.

### **2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS**

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.

- B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
  - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
- C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
- D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

## **2.04 FIRESTOPPING SYSTEMS**

- A. Firestopping: Any material meeting requirements.
  - 1. Fire Ratings: See drawings for required systems and ratings.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify openings are ready to receive the work of this section.

### **3.02 PREPARATION**

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

### **3.03 INSTALLATION**

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.
- C. Install labeling required by code.

### **3.04 FIELD QUALITY CONTROL**

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

### **3.05 CLEANING**

- A. Clean adjacent surfaces of firestopping materials.

### **3.06 PROTECTION**

- A. Protect adjacent surfaces from damage by material installation.

**END OF SECTION**

**SECTION 07 9200**  
**JOINT SEALANTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.
- B. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- C. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

**1.03 REFERENCE STANDARDS**

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
- B. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2018.
- C. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2016.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 4. Substrates the product should not be used on.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- F. Executed warranty.

**1.05 QUALITY ASSURANCE**

- A. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
  - 1. Adhesion Testing: In accordance with ASTM C794.
  - 2. Compatibility Testing: In accordance with ASTM C1087.
  - 3. Allow sufficient time for testing to avoid delaying the work.
  - 4. Deliver sufficient samples to manufacturer for testing.
  - 5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

## **1.06 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Nonsag Sealants:
- B. Self-Leveling Sealants:

### **2.02 JOINT SEALANTS - GENERAL**

- A. Sealants and Primers: Provide products with acceptable levels of volatile organic compound (VOC) content; see Section 01 6116.
- B. Colors: As indicated on drawings.

### **2.03 NONSAG JOINT SEALANTS**

### **2.04 SELF-LEVELING JOINT SEALANTS**

### **2.05 ACCESSORIES**

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

### **3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

### **3.03 INSTALLATION**

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install bond breaker backing tape where backer rod cannot be used.
- D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for additional requirements.



- B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

**END OF SECTION**

**SECTION 08 1113**  
**HOLLOW METAL DOORS AND FRAMES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Hollow metal borrowed lites glazing frames.
- F. Accessories, including glazing, louvers, and matching panels.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 7100 - Door Hardware.
- B. Section 09 9113 - Exterior Painting: Field painting.
- C. Section 09 9123 - Interior Painting: Field painting.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2019.
- C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2018.
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.
- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
- I. BHMA A156.115 - Hardware Preparation In Steel Doors And Steel Frames; 2016.
- J. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- K. ITS (DIR) - Directory of Listed Products; current edition.
- L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- N. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2017.
- O. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; 2018.
- P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
- R. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- S. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2019.

- T. UL (DIR) - Online Certifications Directory; Current Edition.
- U. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- V. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- D. Manufacturer's Qualification Statement.
- E. Installer's Qualification Statement.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Hollow Metal Doors and Frames:
  1. Ceco Door, an Assa Abloy Group company: [www.assaabloydss.com](http://www.assaabloydss.com).
  2. Republic Doors: [www.republicdoor.com](http://www.republicdoor.com).
  3. Steelcraft, an Allegion brand: [www.allegion.com/sle](http://www.allegion.com/sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 PERFORMANCE REQUIREMENTS**

- A. Requirements for Hollow Metal Doors and Frames:
  1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
  2. Accessibility: Comply with ICC A117.1 and ADA Standards.
  3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
  4. Door Edge Profile: Manufacturer's standard for application indicated.
  5. Typical Door Face Sheets: Flush.
  6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
  7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
  8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.

- a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

### 2.03 HOLLOW METAL DOORS

- A. Exterior Doors: Thermally insulated.
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 20 gauge, 0.032 inch (0.8 mm), minimum.
    - e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
  - 2. Door Thermal Resistance: R-Value of 6.0 minimum, for installed thickness of polystyrene.
  - 3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
  - 4. Door Face Sheets: Flush.
  - 5. Weatherstripping: Refer to Section 08 7100.
  - 6. Door Finish: Factory primed and field finished.
- B. Interior Doors, Non-Fire Rated:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 20 gauge, 0.032 inch (0.8 mm), minimum.
  - 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
  - 3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
  - 4. Door Finish: Factory primed and field finished.
- C. Fire-Rated Doors:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
    - e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
  - 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
    - a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
    - b. Attach fire rating label to each fire rated unit.
  - 3. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
  - 4. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
  - 5. Door Finish: Factory primed and field finished.

### 2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Exterior Door Frames: Full profile/continuously welded type.
  - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.

2. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
  3. Frame Finish: Factory primed and field finished.
  4. Weatherstripping: Separate, see Section 08 7100.
- C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
1. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.
  2. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
  3. Frame Finish: Factory primed and field finished.
- D. Door Frames, Fire-Rated: Full profile/continuously welded type.
1. Fire Rating: Same as door, labeled.
  2. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.
  3. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
  4. Frame Finish: Factory primed and field finished.
- E. Mullions for Pairs of Doors: Fixed, except where removable is indicated, with profile similar to jambs.
- F. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match interior door frames, and as indicated on drawings.
- G. Transom Bars: Fixed, of profile same as jamb and head.
- H. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- I. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches (102 mm) high to fill opening without cutting masonry units.
- J. Frames Wider than 48 inches (1219 mm): Reinforce with steel channel fitted tightly into frame head, flush with top.
- K. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.

## 2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
  1. Color: As indicated on drawings.
- C. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch (0.4 mm) dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
  1. Fire-Rated Frames: Comply with fire rating requirements indicated.

## 2.06 ACCESSORIES

- A. Louvers: Roll formed steel with overlapping frame; finish same as door components; factory-installed.
  1. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.
  2. Style: Standard straight slat blade.
  3. Fasteners: Exposed or concealed fasteners.
- B. Glazing: As specified in Section 08 8000, factory installed.
- C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

## **2.07 FINISHES**

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
  - 1. Color: As indicated on drawings.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

### **3.02 PREPARATION**

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

### **3.03 INSTALLATION**

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Install door hardware as specified in Section 08 7100.
- E. Comply with glazing installation requirements of Section 08 8000.
- F. Coordinate installation of electrical connections to electrical hardware items.
- G. Touch up damaged factory finishes.

### **3.04 TOLERANCES**

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

### **3.05 ADJUSTING**

- A. Adjust for smooth and balanced door movement.

### **3.06 SCHEDULE**

- A. Refer to Door and Frame Schedule on the drawings.

**END OF SECTION**

**SECTION 08 1416**  
**FLUSH WOOD DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Flush wood doors; flush and flush glazed configuration; fire rated, non-rated, special function, and sliding.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 1113 - Hollow Metal Doors and Frames.
- B. Section 08 7100 - Door Hardware.
- C. Section 08 8000 - Glazing.

**1.03 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
- C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- D. AWI (QCP) - Quality Certification Program; Current Edition.
- E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- H. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
- I. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2022.
- J. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- K. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- L. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- M. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
  - 1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- E. Specimen warranty.
- F. Samples: Submit two samples of door construction, 8 by 8 inch (203 by 203 mm) in size cut from top corner of door.
- G. Samples: Submit two samples of door veneer, 8 by 8 inch (203 by 203 mm) in size illustrating wood grain, stain color, and sheen.
- H. Manufacturer's Installation Instructions: Indicate special installation instructions.
- I. Warranty, executed in Owner's name.

## 1.05 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
  - 1. Company with at least one project within past five years with value of woodwork within at least 20 percent of cost of woodwork for this project.
  - 2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- C. Woodwork Quality Assurance Program:
  - 1. Comply with AWI (QCP) woodwork association quality assurance service/program in accordance with requirements for work specified in this section; [www.awiqcp.org/#sle](http://www.awiqcp.org/#sle).
    - a. This AWI (QCP) project is registered as project number 20.0207.
  - 2. Provide labels indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
  - 3. Provide designated labels on shop drawings as required by quality assurance program.
  - 4. Provide designated labels on installed products as required by quality assurance program.
  - 5. Submit documentation upon completion of installation that verifies this work is in compliance with specified requirements.
  - 6. Arrange and pay for inspections required for certification.
  - 7. Replace, repair, or rework all work for which certification is refused.
- D. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire-rating as indicated.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

## 1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. High Pressure Decorative Laminate (HPDL) Faced Doors:
  - 1. Ampco Products, Inc: [www.ampco.com/#sle](http://www.ampco.com/#sle).
  - 2. Oregon Door: [www.oregondoor.com/#sle](http://www.oregondoor.com/#sle).
  - 3. Poncraft Door Co: [www.poncraft.com/#sle](http://www.poncraft.com/#sle).
  - 4. VT Industries, Inc: [www.vtindustries.com/#sle](http://www.vtindustries.com/#sle).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.

### 2.02 DOORS

- A. Doors: See drawings for locations and additional requirements.
  - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
  - 2. High Pressure Decorative Laminate (HPDL) Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
  - 1. Provide solid core doors at each location.



2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
3. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft (0.01524 cu m/s/sq m) of door opening at 0.10 inch wg (24.9 Pa) pressure at both ambient and elevated temperatures for "S" label; if necessary, provide additional gasketing or edge sealing.
4. High pressure decorative laminate (HPDL) finish as indicated on drawings.

### **2.03 DOOR AND PANEL CORES**

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

### **2.04 DOOR FACINGS**

- A. High Pressure Decorative Laminate (HPDL) Facing for Fire Doors: NEMA LD 3, SGF; Nevamar Beige Renaissance (to closely match existing door laminate) color; textured, low gloss finish.

### **2.05 ACCESSORIES**

- A. Hollow Metal Door Frames: As specified in Section 08 1113.
- B. Metal Louvers: Specified in Section 08 9100.
- C. Glazed Openings:
  1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048
  2. Fire-Protection-Rated Glass: Safety Certification, 16 CFR 1201, Category II.
  3. Glazing: Single vision units, 1/4 inch (6 mm) glass.
  4. Tint: Clear.
- D. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- E. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge.
- F. Astragals for Fire Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors.
- G. Door Hardware: As specified in Section 08 7100.

### **2.06 DOOR CONSTRUCTION**

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
  1. Provide solid blocks at lock edge for hardware reinforcement.
  2. Provide solid blocking for other throughbolted hardware.
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- G. Cut and configure exterior door edge to receive recessed weatherstripping devices.
- H. Provide edge clearances in accordance with the quality standard specified.

## **2.07 ACCESSORIES**

- A. Hollow Metal Door Frames: See Section 08 1113.
- B. Glazed Openings:
  - 1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
  - 2. Fire-Protection-Rated Glass: Safety Certification, 16 CFR 1201, Category II.
- C. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- D. Door Hardware: See Section 08 7100.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that 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.

### **3.02 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
  - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
  - 2. Install smoke and draft control doors in accordance with NFPA 105 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.
- F. Install door louvers plumb and level.

### **3.03 TOLERANCES**

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

### **3.04 ADJUSTING**

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

### **3.05 SCHEDULE**

- A. Refer to Door and Frame Schedule included in drawings.

**END OF SECTION**

**SECTION 08 3800  
TRAFFIC DOORS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Food Service Doors.
- B. Hardware and accessories.

**1.2 SUBMITTALS**

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Operation and maintenance data.
- C. Shop Drawings: Show fabrication and installation details; include door elevations, head, jamb, and meeting stile details including full or partial gaskets.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.

**1.4 PROJECT CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

**1.5 WARRANTY**

- A. Manufacturer's standard two-year warranty that products are free of defects in material and workmanship, guaranteeing to replace (exclusive of freight and labor) parts proven defective within two years after date of shipment to purchaser.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Acceptable Manufacturer: Eliason Corporation; P.O. Box 2128, Kalamazoo, MI 49003. ASD. Tel: (800) 828-3655. Fax: (800) 828-3577. Email: doors@eliasoncorp.com www.eliasoncorp.com, www.restaurantdoors.net, and www.supermarketdoors.net
- B. Substitutions: See Section 01 6000 – Product Requirements.

**2.2 FOOD SERVICE DOORS**

- A. Food Service Doors: 3/4 inch (19 mm) exterior grade solid wood core; 1 inch (25 mm) total thickness; light to medium duty.
  - 1. Facing: Decorative plastic laminate. (Model SCP-8)
    - a. Top Panels: 0.032 inch (0.81 mm) decorative laminate, both sides.
    - b. Base Plates: 18 inches (457 mm) high 18 gauge (1.27 mm) stainless steel both sides; stainless steel edge trim and top hinge covers.
  - 2. Window Size: 9 inches (229 mm) wide by 14 inches (356 mm) high.
  - 3. Window Molding: Black rubber molding.
  - 4. Glazing: Clear acrylic.
  - 5. Laminate Finish: As selected from manufacturer's standard selection.

**2.3 HARDWARE AND ACCESSORIES**

- A. Hinges: Double Action Easy Swing(r) proprietary hinges.
  - 1. Finish: Zinc coated.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify jambs plumb and square.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

**3.2 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

**3.3 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Minimum jamb construction of double studded 2 by 4 wood construction or equivalent.
- C. Reinforce hollow metal jambs at hardware locations.
- D. Steel channel jambs are required for heavy duty traffic doors.

**3.4 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION**

**SECTION 08 4500**  
**TRANSLUCENT WALL AND ROOF ASSEMBLIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Sandwich panel translucent wall system.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 9200 - Joint Sealants: Sealing joints between perimeter frame and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. AAMA CW-DG-1 - Aluminum Curtain Wall Design Guide Manual; 1996, with Editorial Revision (2005).
- B. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- C. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- F. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- G. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with installation of water-resistive barrier.

**1.05 QUALITY ASSURANCE**

- A. Perform work in accordance with AAMA CW-DG-1.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Sandwich Panel - Translucent Wall and Roof Systems:
  - 1. Kalwall; 2-3/4" wall panel unit system: [www.kalwall.com](http://www.kalwall.com).
  - 2. Major Industries, Inc; equivalent of Kalwall identified above: [www.majorskylights.com/sle](http://www.majorskylights.com/sle).

**2.02 PERFORMANCE REQUIREMENTS**

- A. System Assembly: Accommodate without damage to system, components or deterioration of seals; movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; deflection of structural support framing, tolerance of supporting components, shortening of building concrete structural columns.
- B. Air Leakage: Limit air leakage through assembly to 0.06 cu ft/min sq ft of sloped glazed area, measured at pressure differential across assembly of 1.57 psf in accordance with ASTM E283/E283M.
- C. Water Leakage: None, when measured in accordance with ASTM E331 at a test pressure difference of 2.86 psf.

- D. Expansion/Contraction: System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components.
- E. System Internal Drainage: Drain water entering joints, condensation occurring in framing system, or migrating moisture occurring within system, to the exterior by a weep drainage network.
- F. Fabricate to prevent vibration harmonics, thermal movement transmitted to other building elements, and loosening, weakening, or fracturing of attachments or components of system.

## **2.03 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.

## **2.04 COMPONENTS**

## **2.05 FABRICATION**

- A. Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, and ensure proper installation and dynamic movement of perimeter seals.
- B. Accurately fit and secure joints and corners. Make joints flush and hairline.
- C. Prepare components to receive fabricated anchor devices.
- D. Locate fasteners and attachments to ensure concealment from view.
- E. Reinforce framing members for external imposed loads.
- F. Thermally broken grid core.

## **2.06 FINISHES**

- A. Color: To be selected by Architect.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install translucent panel system with cells vertical in accordance with manufacturer instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.

### **3.02 TOLERANCES**

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 1/2 inch per 100 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

### **3.03 FIELD QUALITY CONTROL**

- A. Provide independent inspection under provisions of Section 01 4000 - Quality Requirements.
- B. Contractor shall include cost of Test for installed curtain wall for water leakage in accordance with AAMA 501.2.
- C. Replace curtain wall components that have failed field testing and retest until performance is satisfactory.

### **3.04 ADJUSTING**

- A. Adjust operating sash for smooth operation.

### **3.05 CLEANING**

- A. Remove protective material from prefinished aluminum surfaces.

- B. Wash down interior and exterior surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths; remove dirt from corners and wipe surfaces clean.

**3.06 PROTECTION**

- A. Protect finished work from damage until Date of Substantial Completion.

**END OF SECTION**

**SECTION 08 5113**  
**ALUMINUM WINDOWS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Extruded aluminum windows with fixed sash and infill panels.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Rough opening framing.
- B. Section 06 1000 - Rough Carpentry: Wood perimeter shims.
- C. Section 07 2500 - Weather Barriers: Sealing frame to water-resistive barrier installed on adjacent construction.
- D. Section 07 9200 - Joint Sealants: Sealing joints between window frames and adjacent construction.
- E. Section 08 8000 - Glazing.

**1.03 REFERENCE STANDARDS**

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2017.
- B. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- C. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products; 2021.
- D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- E. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- F. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- G. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021.
- H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- K. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).
- M. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).
- N. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.
- O. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2019c.



#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week before starting work of this section.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Include component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.
- C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, anchorage locations, and installation requirements.
- D. Samples:
  - 1. Framing: Two samples, 12 by 12 inch in size illustrating typical corner construction, accessories, and finishes.
- E. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
  - 1. Evidence of AAMA Certification.
  - 2. Evidence of WDMA Certification.
  - 3. Evidence of CSA Certification.
  - 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- F. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.
- G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- H. Installer's qualification statement.
- I. Specimen warranty.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with requirements of AAMA CW-10.
- B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

#### **1.08 FIELD CONDITIONS**

- A. Do not install sealants when ambient temperature is less than 40 degrees F.
- B. Maintain this minimum temperature during and 24 hours after installation of sealants.

#### **1.09 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Manufacturer Warranty: Provide 5-year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units. Complete forms in Owner's name and register with manufacturer.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Aluminum Windows Manufacturers:
  - 1. Arcadia, Inc: [www.arcadiainc.com/#sle](http://www.arcadiainc.com/#sle).

2. Boyd Aluminum: [www.boydaluminum.com/#sle](http://www.boydaluminum.com/#sle).
3. ES Windows; ES-P250: [www.eswindows.com/#sle](http://www.eswindows.com/#sle).
4. Manko Window Systems, Inc: [www.mankowindows.com/#sle](http://www.mankowindows.com/#sle).
5. Peerless Products, Inc: [www.peerlessproducts.com/#sle](http://www.peerlessproducts.com/#sle).
6. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 BASIS OF DESIGN - AW PERFORMANCE CLASS WINDOWS**

- A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 having Performance Class of AW, and Performance Grade at least as high as specified design pressure.
- B. Fixed, Thermally-Broken:
  1. Basis of Design: Boyd Aluminum; Series 4000 Fixed, 4 inch deep frame, Thermally Broken: [www.boydaluminum.com/#sle](http://www.boydaluminum.com/#sle).
- C. Substitutions: See Section 01 6000 - Product Requirements.
  1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

## **2.03 ALUMINUM WINDOWS**

- A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
  1. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
  2. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
  3. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
  4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- B. Fixed, Non-Operable Type:
  1. Construction: Thermally broken.
  2. Glazing: Double; gray tinted; low-e.
  3. Exterior Finish: Class I natural anodized.

## **2.04 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

## **2.05 FINISHES**

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41, clear anodic coating not less than 0.7 mil thick.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive aluminum windows; see Section 07 2500.

### **3.02 PRIME WINDOW INSTALLATION**

- A. Install windows in accordance with manufacturer's instructions.
- B. Install window assembly in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
- C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- E. Install sill and sill end angles.

- F. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- G. Install glass and infill panels in accordance with requirements; see Section 08 8000.

### **3.03 TOLERANCES**

- A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft non-cumulative or 1/8 inches per 10 ft, whichever is less.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- B. Provide field testing of installed aluminum windows by independent laboratory in accordance with AAMA 502 and AAMA/WDMA/CSA 101/I.S.2/A440 during construction process and before installation of interior finishes.
  - 1. Field test for water penetration in accordance with ASTM E1105 using Procedure B - cyclic static air pressure difference; test pressure shall not be less than 1.9 psf.
  - 2. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf.
- C. Repair or replace fenestration components that have failed designated field testing, and retest to verify performance complies with specified requirements.

### **3.05 CLEANING**

- A. Remove protective material from factory finished aluminum surfaces.
- B. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

**END OF SECTION**

**SECTION 087100**  
**DOOR HARDWARE**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes commercial door hardware for the following:
1. Swinging doors.
  2. Sliding doors.
  3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
1. Mechanical door hardware.
  2. Electromechanical door hardware.
  3. Automatic operators.
  4. Cylinders specified for doors in other sections.
- C. Related Sections:
1. Division 08 Section "Hollow Metal Doors and Frames".
  2. Division 08 Section "Flush Wood Doors".
  3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
  4. Division 08 Section "Automatic Door Operators".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  2. ICC/IBC - International Building Code.
  3. NFPA 70 - National Electrical Code.
  4. NFPA 80 - Fire Doors and Windows.
  5. NFPA 101 - Life Safety Code.
  6. NFPA 105 - Installation of Smoke Door Assemblies.
  7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
  8. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
1. ANSI/BHMA Certified Product Standards - A156 Series.
  2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
  3. ANSI/UL 294 - Access Control System Units.
  4. UL 305 - Panic Hardware.

### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  - 3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
  - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    - b. Complete (risers, point-to-point) access control system block wiring diagrams.
    - c. Wiring instructions for each electronic component scheduled herein.
  - 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and

special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

- E. Informational Submittals:
  - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

#### **1.4 QUALITY ASSURANCE**

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
  - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
  - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
  - 1. Function of building, purpose of each area and degree of security required.
  - 2. Plans for existing and future key system expansion.
  - 3. Requirements for key control storage and software.
  - 4. Installation of permanent keys, cylinder cores and software.
  - 5. Address and requirements for delivery of keys.

- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
  - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
  - 3. Review sequence of operation narratives for each unique access controlled opening.
  - 4. Review and finalize construction schedule and verify availability of materials.
  - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### **1.6 COORDINATION**

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

## **1.7 WARRANTY**

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 SCHEDULED DOOR HARDWARE**

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
  - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Please note that ASSA ABLOY is transitioning the Yale Commercial brand to ASSA ABLOY ACCENTRA. This affects only the brand name; the products and product numbers will remain unchanged. The brand transition is expected to be complete in or about May of 2024, and products shipping after that time will be branded ASSA ABLOY ACCENTRA.
- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

### **2.2 BUTT HINGES**

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
  - 1. Quantity: Provide the following hinge quantity:



- a. Two Hinges: For doors with heights up to 60 inches.
  - b. Three Hinges: For doors with heights 61 to 90 inches.
  - c. Four Hinges: For doors with heights 91 to 120 inches.
  - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
  3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
  4. Hinge Options: Comply with the following:
    - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
  5. Manufacturers:
    - a. McKinney (MK) - TA/T4A Series, 5-knuckle.

### **2.3 CONTINUOUS HINGES**

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
  1. Manufacturers:
    - a. Pemko (PE).

### **2.4 SLIDING AND FOLDING HARDWARE**

- A. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should conform with ANSI/BHMA A156.14.
  1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.
  2. Manufacturers:
    - a. Pemko (PE).

### **2.5 POWER TRANSFER DEVICES**

- A. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:
  - a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
  - b. McKinney (MK) - Connector Hand Tool: QC-R003.
2. Manufacturers:
  - a. McKinney (MK) - QC-C Series.

## **2.6 DOOR OPERATING TRIM**

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
  1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
  2. Furnish dust proof strikes for bottom bolts.
  3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
  4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
  5. Manufacturers:
    - a. Rockwood (RO).
- B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
  1. Manufacturers:
    - a. Rockwood (RO).
- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
  1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
  2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
  3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
  4. Pulls, where applicable, shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
  5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
  6. Manufacturers:
    - a. Rockwood (RO).

## **2.7 CYLINDERS AND KEYING**

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
  1. Manufacturers:
    - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA).
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
  2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
  4. Tubular deadlocks and other auxiliary locks.
  5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  6. Keyway: Manufacturer's Standard.
- C. Small Format Interchangeable Cores: Provide small format interchangeable cores (SFIC) as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
  2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
  3. New System: Key locks to a new key system as directed by the Owner.
- E. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
  2. Master Keys (per Master Key Level/Group): Five (5).
  3. Construction Keys (where required): Ten (10).
  4. Construction Control Keys (where required): Two (2).
  5. Permanent Control Keys (where required): Two (2).
- F. Construction Keying: Provide construction master keyed cylinders.
- G. Construction Keying: Provide temporary keyed construction cores.
- H. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
  2. Provide transcript list in writing or electronic file as directed by the Owner.

## 2.8 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
1. Manufacturers:
    - a. Lund Equipment (LU).
    - b. MMF Industries (MM).
    - c. Telkee (TK).

## 2.9 CYLINDRICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.
1. Provide locksets with functions and features as follows:
    - a. Meets ANSI/BHMA A156.41 for single motion egress.
    - b. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
    - c. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
    - d. Non-handed and fully field reversible.
    - e. Five-year limited warranty for mechanical functions.
  2. Manufacturers:
    - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) 4700LN Series.
- B. Cylindrical Indicator Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed. Listed manufacturers shall meet all functions and features as specified herein.
1. Provide locksets with functions and features as follows:
    - a. Visual status indicators in rose, displaying bold visuals for vacant or occupied lock status.
    - b. Meets ANSI/BHMA A156.41 for single motion egress.
    - c. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
    - d. Three-year limited warranty.
  2. Manufacturers:
    - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - YPL Series.

## 2.10 AUXILIARY LOCKS

- A. Cylindrical Deadlocks: ANSI/BHMA A156.36 Grade 1 Certified Products Directory (CPD) listed deadlocks to fit standard ANSI 161 preparation. Provide tapered collars to resist vandalism and 1" throw solid steel bolt with hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other locksets.
1. Manufacturers:
    - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - D100 Series.

## 2.11 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
  3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

## 2.12 ELECTRIC STRIKES

- A. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.

1. Manufacturers:
  - a. HES (HS) - 9400/9500/9600/9700/9800 Series.

- B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

## 2.13 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
  - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
  - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
  8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
  9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
  11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Commercial Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Fabricate latchbolts from cast stainless steel, Pullman type, incorporating a deadlocking feature.
1. Manufacturers:
    - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 6000 Series.

## 2.14 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
  2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
  3. Cycle Testing: Provide closers which have surpassed 15 million cycles.
  4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
  5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
  6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
  7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Heavy duty surface mounted door closers shall have a 30-year warranty.
  2. Manufacturers:
    - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 4400 Series.
    - b. Norton Rixson (NO) - 7500 Series.
- C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to

shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.

1. Manufacturers:
  - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - Unitrol Series.
  - b. Norton Rixson (NO) - Unitrol Series.

## **2.15 ELECTROHYDRAULIC DOOR OPERATORS**

- A. Electrohydraulic Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that meet ANSI/BHMA A156.4 requirements and are UL listed for use on fire rated doors and UL10C certified that comply with requirements for the Americans with Disabilities Act (ADA). Operators shall be verified by GreenCircle to offer energy savings of 19% when compared to similar products to accommodate openings up 250 pounds and 48" wide.
  1. Provide operators with features as follows:
    - a. Non-handed with push and pull side mounting.
    - b. Operates as mechanical surface closer during close cycles, when door is opened manually or if power is off.
    - c. Activation by push button, hands-free or radio frequency devices.
    - d. On board electronics to collect usage and cycle count data to facilitate preventative maintenance/diagnostics.
    - e. Two-year limited warranty.
    - f. Mounting backplate to simplify and speed up installation.
  2. Operators shall have the following functionality:
    - a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.
    - b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.
    - c. Infinite Hold Open: Door will hold open at set position until power is turned off.
    - d. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
    - e. Open Delay: Delays operator opening for locking hardware.
    - f. Overload Safety Shut-Off: After two minutes of receiving a door activation signal, inverter times out and door closes to prevent motor/inverter damage.
    - g. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
    - h. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.
    - i. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
    - j. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.
  3. Manufacturers:
    - a. Norton Rixson (NO) - 6000 Series.

## **2.16 SURFACE MOUNTED CLOSER HOLDERS**

- A. Electromagnetic Door Holders: ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate 12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.
  - 1. Manufacturers:
    - a. Norton Rixson (RF) - 980/990 Series.

## **2.17 ARCHITECTURAL TRIM**

- A. Door Protective Trim
  - 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
  - 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
  - 3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
  - 4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
    - a. Stainless Steel: 300 grade, 050-inch thick.
  - 5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
  - 6. Manufacturers:
    - a. Rockwood (RO).

## **2.18 DOOR STOPS AND HOLDERS**

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  - 1. Manufacturers:
    - a. Rockwood (RO).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
  - 1. Manufacturers:



- a. Norton Rixson (RF).

## **2.19 ARCHITECTURAL SEALS**

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: 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 UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
  - 1. Pemko (PE).

## **2.20 ELECTRONIC ACCESSORIES**

- A. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.
  - 1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
  - 2. Manufacturers:
    - a. Securitron (SU) - AQL Series.

## **2.21 FABRICATION**

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## **2.22 FINISHES**

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### **3.2 PREPARATION**

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

### **3.3 INSTALLATION**

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
  3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### **3.4 FIELD QUALITY CONTROL**

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

### **3.5 ADJUSTING**

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### **3.6 CLEANING AND PROTECTION**

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
1. Quantities listed are for each pair of doors, or for each single door.
  2. The supplier is responsible for handing and sizing all products.
  3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
  4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

#### B. Manufacturer's Abbreviations:

1. MK - McKinney
2. HA - Hager
3. PE - Pemko
4. RF - Rixson
5. RO - Rockwood
6. YA - Arrow, formerly known as Yale
7. HS - HES
8. OT - Other
9. NO - Norton
10. SU - Securitron

#### Hardware Sets

##### Set: 1.0

Doors: 143

1 Continuous Hinge	CFM_SLF-HD1		PE
1 Fire Rated Rim Exit, Nightlatch	6100FED 121NL x Temp SFIC	630	YA
1 Small Format Inter Core	A600	626	YA
1 ElectroLynx Adaptor	2004M		HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Electric Strike	9500	630	HS
1 Door Pull	RM3311-12	US32D	RO
1 Surface Closer	UNI4400	689	YA
1 Threshold	171A		PE
1 Gasketing	By Aluminum Frame Mfg.		OT
1 Sweep	315CN		PE
1 ElectroLynx Harness	QC-C1500P		MK

1 Card Reader	Miwa Card Reader by Owner		OT
1 Power Supply	AQL (R8E1 as req'd)		SU

**Notes: Operation Description:**

Door normally closed, latched, and locked.  
Presenting valid credential or key override to unlock.  
Door remains locked when power fails.  
Free to egress at all times.

**Set: 2.0**

Doors: 127

1 Continuous Hinge	CFM_SLF-HD1		PE
1 Rim Exit Device, Nightlatch	6100ED 121NL x Temp SFIC	630	YA
1 Small Format Inter Core	A600	626	YA
1 Electric Strike	9600	630	HS
1 ElectroLynx Adaptor	2004M		HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Door Pull	RM3311-12	US32D	RO
1 Surface Closer	4400	689	YA
1 Door Stop	406/409/441H per condition	US26D	RO
1 Threshold	171A		PE
1 Gasketing	By Aluminum Frame Mfg.		OT
1 Sweep	315CN		PE
1 ElectroLynx Harness	QC-C1500P		MK
1 Card Reader	Miwa Card Reader by Owner		OT
1 Power Supply	AQL (R8E1 as req'd)		SU

**Notes: Operation Description:**

Door normally closed, latched, and locked.  
Presenting valid credential or key override to unlock.  
Door remains locked when power fails.  
Free to egress at all times.

**Set: 3.0**

Doors: 500b, 509c, 509d, 510b

2 Continuous Hinge	CFM_SLF-HD1		PE
1 CVR Exit Device, Exit Only	6160ED EO	630	YA
1 CVR Exit Device, Nightlatch	6160ED 121NL x Temp SFIC	630	YA
1 Small Format Inter Core	A600	626	YA
2 Door Pull	RM3311-12	US32D	RO
2 Surface Closer	UNI4400	689	YA
1 Threshold	171A		PE
1 Gasketing	By Aluminum Frame Mfg.		OT
1 Gasketing	By Aluminum Door Mfg.		OT
2 Sweep	315CN		PE

**Set: 3A.0**

Doors: 500a, 506a

2 Continuous Hinge	CFM_SLF-HD1		PE
1 CVR Exit Device, Exit Only	6160ED EO	630	YA
1 CVR Exit Device, Nightlatch	6160ED 121NL x Temp SFIC	630	YA

1 Small Format Inter Core	A600	626	YA
2 Door Pull	RM3311-12	US32D	RO
1 Surface Closer	UNI4400	689	YA
1 Threshold	171A		PE
1 Gasketing	By Aluminum Frame Mfg.		OT
1 Gasketing	By Aluminum Door Mfg.		OT
2 Sweep	315CN		PE
1 Automatic Opener (Sgl)	6000 Series	689	NO
2 Auto Operator Actuator	500 Series		NO

Notes: Exit Device to be dogged down to use auto operator.  
Push actuator to use auto operator.

**Set: 4.0**

Doors: 507

1 Continuous Hinge	CFM_SLF-HD1		PE
1 Rim Exit Device, Nightlatch	6100ED 121NL x Temp SFIC	630	YA
1 Small Format Inter Core	A600	626	YA
1 Door Pull	RM3311-12	US32D	RO
1 Surface Closer	UNI4400	689	YA
1 Threshold	171A		PE
1 Gasketing	By Aluminum Frame Mfg.		OT
1 Sweep	315CN		PE

**Set: 5.0**

Doors: 134b, 515

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Rim Exit Device, Nightlatch	6100ED 632F x Temp SFIC	630	YA
1 Small Format Inter Core	A600	626	YA
1 Surface Closer	UNI4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Threshold	171A		PE
1 Rain Guard	346A		PE
1 Gasketing	303AS		PE
1 Sweep	315CN		PE

**Set: 6.0**

Doors: 517

3 Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
1 Storeroom Lock	AU 4705LN x Temp SFIC	626	YA
1 Surface Closer	UNI4400	689	YA
1 Armor Plate	K1050 36" high CSK BEV	US32D	RO
1 Threshold	171A		PE
1 Rain Guard	346A		PE
1 Gasketing	303AS		PE
1 Sweep	315CN		PE

**Set: 7.0**

Doors: 128b

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
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1 Storeroom Lock	AU 4705LN x Temp SFIC	626	YA
1 Small Format Inter Core	A600	626	YA
1 Surface Closer	4400	689	YA
1 Door Stop	406/409/441H per condition	US26D	RO
1 Threshold	171A		PE
1 Gasketing	303AS		PE
1 Sweep	315CN		PE

**Set: 8.0**

Doors: 129, 516

3 Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
1 Storeroom Lock	AU 4705LN x Temp SFIC	626	YA
1 Small Format Inter Core	A600	626	YA
1 Surface Closer	UNI4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Threshold	171A		PE
1 Rain Guard	346A		PE
1 Gasketing	303AS		PE
1 Sweep	315CN		PE

**Set: 9.0**

Doors: 500d

2 Continuous Hinge	CFM_SLF-HD1		PE
2 Door Pull	RM3311-12	US32D	RO
2 Push Bar	RM3112	US32D	RO
2 Surface Closer	UNI4400	689	YA
1 Gasketing	By Aluminum Frame Mfg.		OT
1 Gasketing	By Aluminum Door Mfg.		OT

**Set: 9A.0**

Doors: 500c, 506b

2 Continuous Hinge	CFM_SLF-HD1		PE
2 Door Pull	RM3311-12	US32D	RO
2 Push Bar	RM3112	US32D	RO
1 Surface Closer	UNI4400	689	YA
1 Gasketing	By Aluminum Frame Mfg.		OT
1 Gasketing	By Aluminum Door Mfg.		OT
1 Automatic Opener (Sgl)	6000 Series	689	NO
2 Auto Operator Actuator	500 Series		NO

Notes: Push actuator to use auto operator.

**Set: 10.0**

Doors: 509a, 509b

6 Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
2 SVR Exit Device, Classroom	6170ED LBR AU626F x Temp SFIC	630	YA
2 Small Format Inter Core	A600	626	YA
2 Surface Closer	UNI4400	689	YA
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Gasketing	S88BL		PE

2 Astragal	305CN		PE
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**Set: 11.0**

Doors: 510a

6 Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
2 SVR Exit Device, Passage	6170ED LBR AU628F	630	YA
2 Surface Closer	UNI4400	689	YA
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO
2 Astragal	305CN		PE
2 Silencer	608-RKW		RO

**Set: 12.0**

Doors: 229, 230, 329, 330, 429, 430

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Fire Rated Rim Exit, Passage	6100FED AU628F	630	YA
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Door Stop	406/409/441H per condition	US26D	RO
1 Gasketing	S88BL		PE

**Set: 13.0**

Doors: 146

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Fire Rated Rim Exit, Passage	6100FED AU628F	630	YA
1 Surface Closer	UNI4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Gasketing	S88BL		PE

**Set: 14.0**

Doors: 120, 128a

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Card Reader Lock	Miwa Hospitality Lock by Architect		OT
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Door Stop	406/409/441H per condition	US26D	RO
3 Silencer	608-RKW		RO

**Set: 15.0**

Doors: 144, 223, 231, 323, 331, 423, 431

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Card Reader Lock	Miwa Hospitality Lock by Architect		OT
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Door Stop	406/409/441H per condition	US26D	RO
1 Gasketing	S88BL		PE

**Set: 16.0**

Doors: 136, 137



3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Card Reader Lock	Miwa Hospitality Lock by Architect		OT
1 Surface Closer	UNI4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
3 Silencer	608-RKW		RO

**Set: 17.0**

Doors: [142](#)

1 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
3 Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
2 Spring Hinge	1502	US26D	MK
1 Auto Flush Bolt Set	2845/2945	US32D	RO
1 Dust Proof Strike	570	US26D	RO
1 Card Reader Lock	Miwa Hospitality Lock by Architect		OT
1 Coordinator	2600 Series x Brackets as req'd	Black	RO
1 Surface Closer	4400	689	YA
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO
2 Electromagnetic Holder	998M	689	RF
1 Gasketing	S88BL		PE
2 Astragal	305CN		PE

Notes: Connect holder to fire alarm system to release upon fire alarm.

Operation Description:

Doors are normally held open by electromagnetic holders.

Holders must be wired to fire alarm system to release upon alarm activation.

Free to egress at all times.

**Set: 18.0**

Doors: [511](#)

6 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
2 Manual Flush Bolt	555/557	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Storeroom Lock	AU 4705LN x Temp SFIC	626	YA
1 Small Format Inter Core	A600	626	YA
2 Door Stop	406/409/441H per condition	US26D	RO
1 Astragal	357SP		PE
2 Silencer	608-RKW		RO

**Set: 19.0**

Doors: [122](#)

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Storeroom Lock	AU 4705LN x Temp SFIC	626	YA
1 Small Format Inter Core	A600	626	YA
1 Door Stop	406/409/441H per condition	US26D	RO
3 Silencer	608-RKW		RO

**Set: 20.0**

Doors: [121](#), [124](#), [130](#), [513](#), [519](#), [524](#)

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
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1 Storeroom Lock	AU 4705LN x Temp SFIC	626	YA
1 Small Format Inter Core	A600	626	YA
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Door Stop	406/409/441H per condition	US26D	RO
3 Silencer	608-RKW		RO

**Set: 21.0**

Doors: 512

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Storeroom Lock	AU 4705LN x Temp SFIC	626	YA
1 Small Format Inter Core	A600	626	YA
1 Surface Closer	UNI4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
3 Silencer	608-RKW		RO

**Set: 22.0**

Doors: 133, 140

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Storeroom Lock	AU 4705LN x Temp SFIC	626	YA
1 Small Format Inter Core	A600	626	YA
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Door Stop	406/409/441H per condition	US26D	RO
1 Gasketing	S88BL		PE

**Set: 23.0**

Doors: 134a

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Storeroom Lock	AU 4705LN x Temp SFIC	626	YA
1 Small Format Inter Core	A600	626	YA
1 Surface Closer	UNI4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Gasketing	S88BL		PE

**Set: 24.0**

Doors: 117, 518

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Entry Lock	AU 4707LN x Temp SFIC	626	YA
1 Small Format Inter Core	A600	626	YA
1 Door Stop	406/409/441H per condition	US26D	RO
3 Silencer	608-RKW		RO

**Set: 25.0**

Doors: 514

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Entry Lock	AU 4707LN x Temp SFIC	626	YA
1 Small Format Inter Core	A600	626	YA
1 Surface Closer	UNI4400	689	YA

1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
3 Silencer	608-RKW		RO

**Set: 26.0**

Doors: 116, 118, 126

3 Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
1 Card Reader Lock	Miwa Hospitality Lock by Architect		OT
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Door Stop	406/409/441H per condition	US26D	RO
1 Gasketing	S88BL		PE

**Set: 27.0**

Doors: 502

6 Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
2 Manual Flush Bolt	555/557	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Classroom Lock	AU 4708LN x Temp SFIC	626	YA
2 Surface Closer	UNI4400	689	YA
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Gasketing	S88BL		PE
2 Astragal	305CN		PE

**Set: 28.0**

Doors: 522

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Classroom Lock	AU 4708LN x Temp SFIC	626	YA
1 Small Format Inter Core	A600	626	YA
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Door Stop	406/409/441H per condition	US26D	RO
3 Silencer	608-RKW		RO

**Set: 29.0**

Doors: 520

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Classroom Lock	AU 4708LN x Temp SFIC	626	YA
1 Small Format Inter Core	A600	626	YA
1 Surf Overhead Stop	10-X36	630	RF
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
3 Silencer	608-RKW		RO

**Set: 30.0**

Doors: 125, 138, 139, 521

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Privacy w/ Indicator	AU YPL02	626	YA
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO

1 Door Stop	406/409/441H per condition	US26D	RO
1 Gasketing	S88BL		PE

**Set: 31.0**

Doors: 225, 325, 425

6 Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
1 Auto Flush Bolt Set	2845/2945	US32D	RO
1 Dust Proof Strike	570	US26D	RO
1 Passage Latch	AU 4701LN	626	YA
1 Coordinator	2600 Series x Brackets as req'd	Black	RO
2 Surface Closer	4400	689	YA
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO
2 Electromagnetic Holder	980M	689	RF
1 Gasketing	S88BL		PE
1 Astragal	357SP		PE

Notes: Connect holder to fire alarm system to release upon fire alarm.

Operation Description:

Doors are normally held open by electromagnetic holders.

Holders must be wired to fire alarm system to release upon alarm activation.

Free to egress at all times.

**Set: 32.0**

Doors: 119, 145

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Passage Latch	AU 4701LN	626	YA
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Door Stop	406/409/441H per condition	US26D	RO
1 Gasketing	S88BL		PE

**Set: 33.0**

Doors: 508a, 508b, 508c

1 Hardware	By Eliason Door		OT
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**Set: 34.0**

Doors: 503, 504

3 Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
1 Deadbolt	D162 x Temp SFIC	626	YA
1 Small Format Inter Core	A600	626	YA
1 Door Pull	RM3301-12	US32D	RO
1 Push Plate	70C-RKW	US32D	RO
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Door Stop	406/409/441H per condition	US26D	RO
1 Gasketing	S88BL		PE

**Set: 35.0**

Doors: TYP 1

3 Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1 Card Reader Lock	Miwa Hospitality Lock by Architect		OT
1 Surface Closer	4400	689	YA
1 Door Stop	406/409/441H per condition	US26D	RO
1 Gasketing	S88BL		PE
1 Privacy Latch	PDLAA	US26	PE
1 Bracket	PDLBRKT		PE
1 Door Viewer	622	STNN	RO

Notes: Provide two (2) viewers for ADA rooms.

**Set: 36.0 (NOT IN USE)**

**Set: 37.0**

Doors: TYP 2

1 Barn Door Hardware Set	BLD-FT01-IS/PACK		PE
2 Door Pull	RM3301-12	US32D	RO

**Set: 38.0**

Doors: G1, G2, G3, G4

1 Rim Exit Device, Nightlatch	6100ED 632F x Temp SFIC	630	YA
1 Small Format Inter Core	A600	626	YA
1 Balance of Hardware	By Gate Supplier		OT

**Set: 39.0**

Doors: 110a, 110b, 112

1 Cylinder/Core	As Req'd	626	YA
1 Hardware	By Sliding Door Mfg.		OT

**END OF SECTION**

## SECTION 08 8000

### GLAZING

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds.

##### 1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.
- B. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- C. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.
- D. Section 08 4313 - Aluminum-Framed Storefronts: Glazing in storefront assembly.

##### 1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- F. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- H. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.
- I. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- J. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
- K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- L. GANA (GM) - GANA Glazing Manual; 2008.
- M. GANA (SM) - GANA Sealant Manual; 2008.
- N. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.
- O. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- P. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).
- Q. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2020.
- R. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2020.
- S. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2020.

##### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 12 by 12 inch (305 by 305 mm) in size of glass units.
- E. Certificate: Certify that products of this section meet or exceed specified requirements.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

### **1.06 QUALITY ASSURANCE**

- A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

### **1.07 FIELD CONDITIONS**

- A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

### **1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Float Glass Manufacturers:
  - 1. PPG Industries, Inc: [www.ppgideascape.com](http://www.ppgideascape.com).
  - 2. AGC Glass Company North America, Inc: [www.us.agc.com](http://www.us.agc.com).
  - 3. Cardinal Glass Industries: [www.cardinalcorp.com](http://www.cardinalcorp.com).
  - 4. Guardian Industries Corp: [www.sunguardglass.com](http://www.sunguardglass.com).
  - 5. Pilkington North America Inc: [www.pilkington.com/na](http://www.pilkington.com/na).
  - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Laminated Glass Manufacturers:
  - 1. Cardinal Glass Industries: [www.cardinalcorp.com](http://www.cardinalcorp.com).
  - 2. Viracon, Architectural Glass segment of Apogee Enterprises, Inc: [www.viracon.com](http://www.viracon.com).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES**

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
  - 1. Design Pressure: Calculated in accordance with ASCE 7.

2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
  3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7.
  4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
  5. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
1. In conjunction with weather barrier related materials described in other sections, as follows:
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  3. Solar Optical Properties: Comply with NFRC 300 test method.

### 2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
  2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
  3. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality-Q3, color and performance characteristics equivalent to SOLARBAN 70XL, tint to be selected from manufacturers full range of colors.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

### 2.04 BASIS OF DESIGN - INSULATING GLASS UNITS

- A. Basis of Design - Insulating Glass Units: Vision glazing, with low-e coating.
1. Applications: Exterior insulating glass glazing unless otherwise indicated.
  2. Space between lites filled with air.
  3. Total Thickness: 1 inch (25.4 mm).
  4. Thermal Transmittance (U-Value), Summer - Center of Glass: .26, nominal.
  5. Visible Light Transmittance (VLT): 51 percent, nominal.
  6. Solar Heat Gain Coefficient (SHGC): .24, **nominal**.
  7. Visible Light Reflectance, Outside: 9 percent, nominal.
  8. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
  9. Spacer Color: Black.
  10. Edge Seal:
  11. Color: Black.
  12. Purge interpane space with dry air, hermetically sealed.
  13. Basis of Design - Vitro Architectural Glass (formerly PPG Glass): [www.vitroglazings.com/#sle](http://www.vitroglazings.com/#sle).
  14. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
    - a. Low-E Coating: Vitro Architectural Glass (formerly PPG Glass) Solarban 70XL on #2 surface.
    - b. Glass Tint: Atlantica (light green).
  15. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick.



- a. Coating: No coating on inboard lite.

## **2.05 GLASS COATINGS**

- A. Bird Protecting UV Strip Coating: Ultra-violet (UV) vertical (perpendicular to horizon) stripe coating applied on outer surface (#1 surface) of IGU, visible to birds to prevent collisions with impending barrier, and virtually invisible to human eye in dry conditions.
  - 1. Application: Locations as indicated on drawings.
  - 2. Coating provides acceptable avoidance index score from American Bird Conservancy for different sizes and species of birds.
  - 3. Manufacturers:
    - a. Guardian Glass, LLC; Guardian Bird1st UV: [www.guardianglass.com/#sle](http://www.guardianglass.com/#sle).
    - b. Substitutions: See Section 01 6000 - Product Requirements.

## **2.06 ACCESSORIES**

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
  - 1. Width: As required for application.
  - 2. Thickness: As required for application.
  - 3. Spacer Rod Diameter: As required for application.
- D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- E. Glazing Clips: Manufacturer's standard type.

## **2.07 SOURCE QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Provide shop inspection and testing for Type IG-1 glass.

## **PART 3 EXECUTION**

### **3.01 VERIFICATION OF CONDITIONS**

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

### **3.02 PREPARATION**

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

### **3.03 INSTALLATION, GENERAL**

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

#### **3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)**

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

#### **3.05 FIELD QUALITY CONTROL**

- A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- B. Monitor and report installation procedures and unacceptable conditions.

#### **3.06 CLEANING**

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

#### **3.07 PROTECTION**

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

**END OF SECTION**

**SECTION 08 8300**  
**MIRRORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Glass mirrors.
  - 1. Annealed float glass.

**1.02 RELATED REQUIREMENTS**

- A. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Metal mirror frames.

**1.03 REFERENCE STANDARDS**

- A. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- B. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- C. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.
- D. GANA (GM) - GANA Glazing Manual; 2008.
- E. GANA (SM) - GANA Sealant Manual; 2008.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Manufacturer's Certificate: Certify that mirrors, meets or exceeds specified requirements.
- D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.

**1.05 QUALITY ASSURANCE**

- A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.
- B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

**1.06 FIELD CONDITIONS**

- A. Do not install mirrors 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.

**1.07 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Mirrors:
  - 1. Binswanger Mirror/ACI Distribution: [www.binswangerglass.com/#sle](http://www.binswangerglass.com/#sle).
  - 2. Lenoir Mirror Co: [www.lenoirmirror.com/#sle](http://www.lenoirmirror.com/#sle).
  - 3. Trulite Glass and Aluminum Solutions: [www.trulite.com/#sle](http://www.trulite.com/#sle).

4. Walker Glass Company Ltd; Walker Glass Mirrors: [www.walkerglass.com/#sle](http://www.walkerglass.com/#sle).
5. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 MATERIALS**

- A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.
- B. Mirror Glass: Clear, annealed float glass; ASTM C1036, with copper and silver coatings, and protective overcoating.
  1. Thickness: 1/4 inch (6.4 mm).
  2. Edges: Arrised.
  3. Size: As indicated on drawings.

## **2.03 ACCESSORIES**

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness.
- C. Glazing Tape: Preformed butyl compound; 10 to 15 Shore A durometer hardness; on release paper.
- D. Mirror Attachment Accessories: Stainless steel clips.
- E. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.
- F. Rolled Formed Frame: One piece, roll-formed angle frame, stainless steel, Type 430, satin finish, with welded frame corners, ground and polished smooth.
- G. Channel Frame: One piece, channel frame, stainless steel, Type 430, satin finish, 1/2 inch by 1/2 inch by 3/8 inch deep (12.7 mm by 12.7 mm by 9.5 mm deep) with 90 degree mitered corners.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

### **3.03 INSTALLATION**

- A. Install mirrors in accordance with manufacturer's recommendations.
- B. Set mirrors plumb and level, and free of optical distortion.
- C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.
- D. Installation in Frames:
  1. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.
  2. Place setting blocks at one-quarter points with edge block no more than 6 inches (152 mm) from corners.
  3. Rest mirrors on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
  4. Place glazing tape on free perimeter of mirrors in same manner described above.
  5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
  6. Trim protruding tape edge.

### **3.04 CLEANING**

- A. Remove wet glazing materials from finish surfaces.
- B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

**END OF SECTION**

**SECTION 09 2116**  
**GYPNUM BOARD ASSEMBLIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Gypsum sheathing.
- F. Cementitious backing board.
- G. Gypsum wallboard.
- H. Joint treatment and accessories.
- I. Textured finish system.
- J. Water-resistive barrier over exterior wall sheathing.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 4000 - Cold-Formed Metal Framing: Structural steel stud framing.
- B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 2100 - Thermal Insulation: Acoustic insulation.
- D. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.
- E. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- F. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

**1.03 REFERENCE STANDARDS**

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2018).
- B. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2012.
- C. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.
- D. ANSI A108.11> ANSI A108/A118/A136.1 - American National Standard for Interior of Cementitious Backer Units; 2010 (Revised).
- E. ANSI A118.9>ANSI A108/A118/A136.1 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2010).
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- G. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.
- H. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.
- I. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.
- J. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- K. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.

- L. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2018.
- M. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2020.
- N. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- O. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- P. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
- Q. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018.
- R. ASTM C1288 - Standard Specification for Fiber-Cement Interior Substrate Sheets; 2017.
- S. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2021.
- T. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- U. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2019.
- V. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019, with Editorial Revision (2020).
- W. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- X. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- Y. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- Z. GA-216 - Application and Finishing of Gypsum Panel Products; 2021.
- AA. GA-226 - Application of Gypsum Board to Form Curved Surfaces; 2019.
- AB. GA-600 - Fire Resistance Design Manual Sound Control; 2021.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- E. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
- F. Samples: Submit two samples of predecorated gypsum board, 12 by 12 inches (300 by 300 mm) in size, illustrating finish color and texture.

#### **1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 10 years of experience.
- B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

## **PART 2 PRODUCTS**

### **2.01 GYPSUM BOARD ASSEMBLIES**

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
  - 1. See PART 3 for finishing requirements.
- B. Interior Partitions, Indicated as Sound-Rated: Provide completed assemblies with the following characteristics:
  - 1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:

### **2.02 METAL FRAMING MATERIALS**

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
  - 1. Clarkwestern Dietrich Building Systems LLC: [www.clarkdietrich.com](http://www.clarkdietrich.com).
  - 2. Jaimes Industries: [www.jaimesind.com/#sle](http://www.jaimesind.com/#sle).
  - 3. Marino: [www.marinoware.com](http://www.marinoware.com).
  - 4. R-stud, LLC: [www.rstud.com/#sle](http://www.rstud.com/#sle).
  - 5. Phillips Manufacturing Co: [www.phillipsmfg.com/#sle](http://www.phillipsmfg.com/#sle).
  - 6. SCAFCO Corporation: [www.scafco.com/#sle](http://www.scafco.com/#sle).
  - 7. Steel Construction Systems: [www.steelconsystems.com/#sle](http://www.steelconsystems.com/#sle).
  - 8. Supreme Steel Framing System Association; Supreme Stud: [www.ssfsa.com/#sle](http://www.ssfsa.com/#sle).
  - 9. Phillips Manufacturing Company: [www.phillipsmfg.com](http://www.phillipsmfg.com).
  - 10. Substitutions: See Section 01 6000 - Product Requirements.
- B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 10 psf (L/240 at 480 Pa).
  - 1. Exception: The minimum metal thickness and section properties requirements of ASTM C 645 are waived provided steel of 40 ksi (275 MPa) minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E 72 using assemblies specified b ASTM C 754.
  - 2. Studs: C-shaped with knurled or embossed faces.
  - 3. Runners: U shaped, sized to match studs.
  - 4. Ceiling Channels: C-shaped.
  - 5. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
- C. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 4000.
- D. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
- E. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- F. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
  - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
  - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
  - 3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
  - 4. Deflection and Firestop Track:
    - a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.



5. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet (3660 mm).

### 2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
  1. BASIS Of DESIGN: USG Corporation; [EcoSmart Panels Mold Tough Firecode X; Developed to meet Architecture 2030 Challenge for Products:]: [www.usg.com/#sle](http://www.usg.com/#sle).
  2. American Gypsum Company; M-Bloc: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
  3. CertainTeed Corporation; M2Tech: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  4. Georgia-Pacific Gypsum; Toughrock Fireguard X Mold-Guard: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  5. National Gypsum Company; eXP Interior Extreme IR Gypsum Panel: [www.nationalgypsum.com/#sle](http://www.nationalgypsum.com/#sle).
  6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
  3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    - a. Mold resistant board is required at all locations.
  4. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  5. Thickness:
    - a. Vertical Surfaces: 5/8 inch (16 mm).
    - b. Ceilings: 5/8 inch (16 mm).
    - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
  6. Mold Resistant Paper Faced Products:
    - a. American Gypsum Company; M-Bloc Type X: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
    - b. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - c. Continental Building Products; Mold Defense Type X: [www.continental-bp.com/#sle](http://www.continental-bp.com/#sle).
    - d. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - e. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
  7. Glass Mat Faced Products:
    - a. Georgia-Pacific Gypsum; DensArmor Plus: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
- C. Abuse Resistant Wallboard:
  1. Application: High-traffic areas indicated.
  2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
  3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
  4. Soft Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
  5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  6. Type: Fire-resistance-rated Type X, UL or WH listed.
  7. Thickness: 5/8 inch (16 mm).
  8. Edges: Tapered.
- D. Backing Board For Wet Areas including backing for Exterior and Interior Adhered Stone: One of the following products:
  1. Application: Surfaces behind adhered stone and tile in wet areas including drinking fountains, backsplashes and where tile is to be installed as indicated on drawings.
  2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A108/A118/A136.1 or ASTM C1325. Use this board for Exterior Adhered Stone.
  - a. Thickness: 1/2 inch (12.7 mm).
  - b. Products:
    - 1) Custom Building Products: [www.custombuildingproducts.com](http://www.custombuildingproducts.com).
    - 2) PermaBASE Building Products, LLC provided by National Gypsum Company; PermaBase Cement Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - 3) USG Corporation: [www.usg.com](http://www.usg.com).
    - 4) Substitutions: See Section 01 6000 - Product Requirements.
4. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288. Use this product for Interior Adhered Stone.
  - a. Thickness: 1/2 inch (12.7 mm).
  - b. Products:
    - 1) James Hardie Building Products, Inc: [www.jameshardie.com](http://www.jameshardie.com).
    - 2) Substitutions: See Section 01 6000 - Product Requirements.
5. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
  - a. Regular Type: Thickness 1/2 inch (12.7 mm).
  - b. Products:
    - 1) Georgia-Pacific Gypsum; DensShield Tile Backer: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - 2) Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Tile Backer: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - 3) Substitutions: See Section 01 6000 - Product Requirements.
- E. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
  1. Application: Vertical surfaces behind thinset tile, except in wet areas.
  2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  4. Type: Regular and Type X, in locations indicated.
  5. Type X Thickness: 5/8 inch (16 mm).
  6. Regular Board Thickness: 1/2 inch (13 mm).
  7. Edges: Tapered.
  8. Products:
    - a. American Gypsum Company; M-Bloc: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
    - b. American Gypsum Company; M-Bloc Type X: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
    - c. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - d. Georgia-Pacific Gypsum; DensArmor Plus: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - e. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - f. Substitutions: See Section 01 6000 - Product Requirements.
- F. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  1. Application: Ceilings, unless otherwise indicated.
  2. Thickness: 5/8 inch (16 mm).
  3. Edges: Tapered.
  4. Products:
    - a. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - b. Substitutions: See Section 01 6000 - Product Requirements.
- G. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
  1. Application: Exterior sheathing, unless otherwise indicated.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
  4. Core Type: Regular and Type X, as indicated.
  5. Type X Thickness: 1/2 and 5/8 inch (16 mm).
  6. Regular Board Thickness: 5/8 and 1/2 inch (13 mm).
  7. Edges: Square.
  8. Glass Mat Faced Products:
    - a. American Gypsum Company; M-Glass 1/2" Exterior Sheathing: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
    - b. Continental Building Products; Weather Defense Platinum Exterior Sheathing: [www.continental-bp.com/#sle](http://www.continental-bp.com/#sle).
    - c. Georgia-Pacific Gypsum; DensGlass Sheathing and DensDeck Prime.
    - d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Sheathing: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - e. Substitutions: See Section 01 6000 - Product Requirements.
- H. Exterior Soffit Board: Exterior gypsum soffit board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings and soffits in protected exterior areas, unless otherwise indicated.
  2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
  3. Types: Regular and Type X, in locations indicated.
  4. Type X Thickness: 1/2 and 5/8 inch (16 mm).
  5. Regular Type Thickness: 5/8 and 1/2 inch (13 mm).
  6. Edges: Tapered.
  7. Products:
    - a. Georgia-Pacific Gypsum; ToughRock Fireguard C Soffit Board: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
- I. Parapet Sheathing at Membrane Roofing: Roof board.
1. Fiberglass mat faced gypsum board with non-asphaltic heat-cured coating on one side.
  2. Edges: Square
  3. Thickness: 5/8"
  4. Size: Nominal 4'x8"
  5. Fire Resistance: Flame Spread 0, smoke developed 0 as described and tested in accordance with ASTM E 84. Noncombustible as described and tested in accordance with ASTM E 136.
  6. Products: Georgia-Pacific DensDeck Prime
- J. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (610 mm) wide, beveled long edges, ends square cut.
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
  2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  3. Products:
    - a. American Gypsum Company; Shaft Liner.
    - b. Georgia-Pacific Gypsum; ToughRock Shaftliner.
    - c. National Gypsum Company; Gold Bond Fire-Shield Shaftliner XP.
    - d. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.04 GYPSUM BOARD ACCESSORIES**

- A. Acoustic Insulation: 1; preformed glass fiber, friction fit type, unfaced. Thickness: 3 and 6 inch. (Thickness: 76 and 152 mm.)
- B. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
  1. Types: As detailed or required for finished appearance.

2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Fiberglass Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
  2. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
  3. Ready-mixed vinyl-based joint compound.
  4. Chemical hardening type compound.
  5. Joint Compound: Setting type, field-mixed.
- D. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- E. Textured Finish Materials: Latex-based compound; plain.
- F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that project conditions are appropriate for work of this section to commence.

#### **3.02 SHAFT WALL INSTALLATION**

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
- B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
  2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

#### **3.03 FRAMING INSTALLATION**

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
- C. Studs: Space studs at 16 inches on center (at 406 mm on center).
1. Extend partition framing to structure where indicated and to ceiling in other locations.
  2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
  3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
1. Orientation: Horizontal.
- F. Acoustic Furring: Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.
- G. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.

- H. Blocking: Install wood blocking for support of:
  - 1. Framed openings.
  - 2. Wall-mounted cabinets.
  - 3. Plumbing fixtures.
  - 4. Toilet partitions.
  - 5. Toilet accessories.
  - 6. Wall-mounted door hardware.
  - 7. Dental and X-Ray Equipment.

### **3.04 ACOUSTIC ACCESSORIES INSTALLATION**

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
  - 1. Place continuous bead at perimeter of each layer of gypsum board.
  - 2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

### **3.05 BOARD INSTALLATION**

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- C. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
  - 1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.
- D. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
- E. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- F. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

### **3.06 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
  - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
  - 2. At exterior soffits, not more than 30 feet (10 meters) apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

### **3.07 JOINT TREATMENT**

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
  - 1. Level 5: Walls and ceilings to receive satin, semi-gloss or gloss paint finish or wall coverings and other areas specifically indicated.
  - 2. Level 4: Walls and ceilings to receive paint finish or light textured finish, unless otherwise indicated.
  - 3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

4. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
  5. Level 0: Temporary partitions.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
- E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- F. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

### **3.08 TEXTURE FINISH**

- A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

### **3.09 TOLERANCES**

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

**END OF SECTION**

## SECTION 09 3000

### TILING

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Slate tile for wall applications.
- D. Cementitious backer board as tile substrate.
- E. Ceramic accessories.
- F. Ceramic trim.
- G. Non-ceramic trim.

##### 1.2 RELATED REQUIREMENTS

- A. Section 07 9513 - Bituminous Dampproofing.
- B. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- C. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.
- D. Section 09 2400 - Cement Plastering: Lath and Portland cement scratch coat, where required by the TCNA (HB) Method specified.

##### 1.3 REFERENCE STANDARDS

- A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2017.
- B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.
- C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- D. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).
- E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
- F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
- H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
- I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
- J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
- K. 11
- L. ANSI A108.11-System Deleted - American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).

- M. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior glue plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- N. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).
- O. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar; 2012 (Revised).
- P. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013 (Revised).
- Q. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).
- R. ANSI A118.5 - American National Standard Specifications for Chemical Resistant Furan Mortars and Grouts for Tile Installation; 1999 (Reaffirmed 2010).
- S. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2010 (Revised).
- T. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).
- U. ANSI A118.9-System Deleted - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2010).
- V. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.
- W. ANSI A118.11 - American National Standard Specifications for EGP (Exterior glue plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- X. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.
- Y. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.
- Z. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.
- AA. ASTM C373 - Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles; 2014a.
- AB. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- AC. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.
- AD. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2016.

#### **14 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

#### **15 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.



- D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Tile: 2 percent of each size, color, and surface finish combination, but not less than 10 square feet of each type.

## 1.6 QUALITY ASSURANCE

- A. Maintain one copy of ANSI A108/A118/A136.1 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

## 1.7 MOCK-UP

- A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
- B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
  - 1. Minimum size of mock-up is indicated on drawings.
  - 2. Approved mock-up may remain as part of the Work.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

## 1.9 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

## PART 2 PRODUCTS

### 21 TILE

- A. Manufacturers: All products of each type by the same manufacturer.
  - 1. **BASIS OF DESIGN:** Arizona Tile, LLC: <https://www.arizonatile.com/> - See interior finish schedule for additional information.
  - 2. Dal-Tile Corporation: [www.daltile.com](http://www.daltile.com).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Porcelain Tile, Type As indicated in drawings: ANSI A137.1, standard grade.
  - 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
  - 2. Size: As Indicated in drawings inch, nominal.
  - 3. Color(s): As indicated on drawings.
  - 4. Trim Units: Matching bullnose, double bullnose, cove base, and cove shapes in sizes coordinated with field tile.
  - 5. Grout Joints: 1/8 inch.
  - 6. Products:
    - a. Arizona Tile; Porcelain Tile, Model - "Shibusa", Color "Crema".
    - b. Arizona Tile; Porcelain Tile, Model - "Shibusa", Color "Tortora".
    - c. Arizona Tile; Porcelain Tile, Model - "Tivoli", Color "Beige".
    - d. Arizona Tile; Porcelain Tile, Model - "Borgo", Color "Caldo".
    - e. Substitutions: See Section 01 6000 - Product Requirements.

### 22 TRIM AND ACCESSORIES

- A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same

manufacturer as tile.

- B. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
  - 1. Applications:
    - a. Open Edges: Bullnose.
    - b. Inside Corners: Jointed.
    - c. Floor to Wall Joints: Cove base.
  - 2. Manufacturers: Same as for tile.
- C. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
  - 1. Applications:
    - a. Open edges of wall tile.
    - b. Open edges of floor tile.
    - c. Wall corners, outside and inside.
    - d. Transition between floor finishes of different heights.
    - e. Thresholds at door openings.
    - f. Floor to wall joints.
  - 2. Manufacturers:
    - a. Schluter-Systems: [www.schluter.com](http://www.schluter.com).
    - b. Custom Building Products; Proround: [custombuildingproducts.com](http://custombuildingproducts.com).
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- D. Prefabricated Shower Components :
  - 1. Products:
    - a. Prefabricated Shower Niche: Schluter-KERDI-BOARD-SN.
    - b. Prefabricated Sloped Shower Pan: Schluter-KERDI-SHOWER-T
    - c. Prefabricated Shower Curb: Schluter-KERDI-BOARD-SC

## **23 SETTING MATERIALS**

- A. Manufacturers:
  - 1. Custom Building Products: [www.custombuildingproducts.com](http://www.custombuildingproducts.com).
  - 2. LATICRETE International, Inc: [www.laticrete.com](http://www.laticrete.com).
- B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4 or ANSI A118.15.
  - 1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
    - a. Use white thin-set modified with latex where glass tile is indicated.
  - 2. Products:
    - a. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: [www.custombuildingproducts.com](http://www.custombuildingproducts.com).
    - b. LATICRETE International, Inc; LATICRETE 254 Platinum: [www.laticrete.com](http://www.laticrete.com).
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- C. Dry-Set Portland Cement Mortar Bond Coat: ANSI A118.1.
  - 1. Applications: Large format tile installations.
  - 2. Products:
    - a. Custom Building Products; MegaLite Ultimate Crack Prevention Large Format Tile Mortar: [custombuildingproducts.com](http://custombuildingproducts.com).

## **24 GROUTS**

- A. Manufacturers:

1. Custom Building Products: [www.custombuildingproducts.com](http://www.custombuildingproducts.com).
  2. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  3. Substitutions: See Section 01 6000 - Product Requirements.
- B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
1. Applications: Use this type of grout where indicated .
  2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
  3. Use non-sanded grout where polished, glass and natural stone tile is indicated.
- C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
1. Applications: Where indicated.
  2. Color(s): As selected by Architect from manufacturer's full line.

## **25 MAINTENANCE MATERIALS**

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and countertops and plumbing fixtures.
  2. Color(s): As selected by Architect from manufacturer's full line.
- B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
1. Composition: Water-based colorless silicone.
  2. Color(s): As selected by Architect from manufacturer's full line.
- C. Tile Sealer: Stain protection for natural stone.
1. Products:
    - a. Substitutions: See Section 01 6000 - Product Requirements.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- E. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
1. Moisture Emission Rate: Not greater than 3 lb per 1000 sq ft per 24 hours, test in accordance with ASTM F1869.
  2. Alkalinity (pH): Verify pH range of 5 to 9, test in accordance with ASTM F710.
- F. Verify that required floor-mounted utilities are in correct location.

### **3.2 PREPARATION**

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with 2 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

### **33 INSTALLATION - GENERAL**

- A. For large format tiles (any edge longer than 15") use a tile leveling system that integrates grout joint spacing and leveling in one piece for even spacing and flush surfaces.
  - 1. Manufacturer and Product: Acufloor Leveling Spacers (available thru Daltile) [www.acufloor.com](http://www.acufloor.com).
- B. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- C. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- F. Form internal angles square and external angles bullnosed.
- G. Install ceramic accessories rigidly in prepared openings.
- H. Install non-ceramic trim in accordance with manufacturer's instructions.
- I. Sound tile after setting. Replace hollow sounding units.
- J. Keep control and expansion joints free of mortar, grout, and adhesive.
- K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
  - 1. Mix and install grout per manufacturer's recommendations.
  - 2. Verify quality of installation of grout. Grout shall be free of visible air voids. Presence of air voids will be unacceptable and contractor shall remove grout and tile as necessary to provide installation of grout without voids. Extent of removal shall be enough such that no variation in color shall be visible between installed grout and replace grout. If color cannot be matched, contractor shall remove and replace all grout and tile as necessary to provide uniform pattern as demonstrated in mock up.
- M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

### **34 INSTALLATION - FLOORS - THIN-SET METHODS**

- A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F102, with standard grout.
- B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
  - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
  - 2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
  - 3. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F131.
  - 4. Where furan bond coat and grout are indicated, install in accordance with TCNA (HB) Method F133.
  - 5. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F115.
- C. Over wood substrates, install in accordance with TCNA (HB) Method F142, with standard grout, unless otherwise indicated.
  - 1. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F143.

- D. Over wood substrate with backer board underlayment, install in accordance with TCNA (HB) Method F144, for cementitious backer boards, with standard grout.

### **35 INSTALLATION - FLOORS - MORTAR BED METHODS**

- A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F101, bonded, with standard grout.
- B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.
  - 1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCNA (HB) Method F121.
  - 2. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F132, bonded.
  - 3. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F114, with cleavage membrane.
- C. Over wood substrates, install in accordance with TCNA (HB) Method F141, with standard grout, unless otherwise indicated.
- D. Cleavage Membrane: Lap edges and ends.
- E. Waterproofing Membrane: Install as recommended by manufacturer 07 1200.
- F. Mortar Bed Thickness: 5/8 inch, unless otherwise indicated.

### **36 INSTALLATION - SHOWERS AND BATHTUB WALLS**

- A. At bathtub walls install in accordance with TCNA (HB) Method B412, over cementitious backer units with waterproofing membrane.
- B. Grout with standard grout as specified above.

### **37 INSTALLATION - WALL TILE**

- A. On exterior walls install in accordance with TCNA (HB) Method W244, thin-set over cementitious backer units, with waterproofing membrane.
- B. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
- C. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.
- D. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.
  - 1. Where mortar bed is indicated, install in accordance with TCNA (HB) Method W222, one coat method.
  - 2. Where waterproofing membrane is indicated other than at showers and bathtub walls, install in accordance with TCNA (HB) Method W222, one coat method.
- E. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.
- F. Over wood studs without backer install in accordance with TCNA (HB) Method W231, mortar bed, with membrane where indicated.
- G. Over metal studs without backer install in accordance with TCNA (HB) Method W241, mortar bed, with membrane where indicated.

### **38 CLEANING**

- A. Clean tile and grout surfaces.

### **39 PROTECTION**

- A. Do not permit traffic over finished floor surface for 4 days after installation.

**END OF SECTION**

**SECTION 09 5100**  
**ACOUSTICAL CEILINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

**1.02 RELATED REQUIREMENTS**

- A. Division 23 - Mechanical.
- B. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.

**1.03 REFERENCE STANDARDS**

- A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- C. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2017.
- D. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.
- E. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
- F. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.
- G. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2022.
- H. ITS (DIR) - Directory of Listed Products; current edition.
- I. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

**1.04 ADMINISTRATIVE REQUIREMENTS**

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

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Samples: Submit two samples 6"x6" inch in size illustrating material and finish of acoustical units.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Manufacturer's Qualification Statement.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

## 1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

## 1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Acoustical Tiles:
  - 1. Armstrong World Industries, Inc.: [www.armstrongceilings.com](http://www.armstrongceilings.com)
    - a. See Drawing Sheets for size and other information.
  - 2. Substitutions: See Section 01 6000 -Product Requirements.
- B. Suspension Systems:
  - 1. Basis of Design - Armstrong World Industries, Inc.: [www.armstrongceilings.com](http://www.armstrongceilings.com)
  - 2. Substitutions: See Section 01 6000 -Product Requirements.

### 2.02 ACOUSTICAL UNITS

- A. See Project Reflected Ceiling Plans, Legends and Interior Material Schedule on Sheet ID601.
- B. Acoustical Panels: with the following characteristics:
  - 1. Basis of Design: Armstrong Silhouette Lay-In
  - 2. Basis of Design: Armstrong Kitchen Zone
- C. Acoustical Panels (ACT-1): with the following characteristics:
  - 1. Basis of Design: Armstrong Ultima with Silhouette XL 9/16" suspension system with 1/8" revel.
  - 2. Color: White.
  - 3. Size: 24-inch x 24-inch.
  - 4. Thickness: 3/4-inch.
  - 5. Edge: Beveled Tegular 9/16
  - 6. Surface Texture: Fine-textured, non-perforated and non-fissured
  - 7. Noise Reduction Coefficient (NRC): 0.75
  - 8. Ceiling Attenuation Class: 35, minimum
  - 9. Sound Blocking: up to 40
  - 10. Light Reflectance: 88%.
  - 11. Sag/humidity Resistance: HUMIGUARD Plus Standard
  - 12. Flame Spread: ASTM E 1264; Class A (UL)
- D. Acoustical Panels (ACT-2): with the following characteristics:
  - 1. Basis of Design: Armstrong Ultima with Silhouette XL 9/16" suspension system with 1/8" revel.
  - 2. Color: White
  - 3. Size: 24-inch x48-inch
  - 4. Thickness: 3/4-inch
  - 5. Edge: Beveled Tegular 9/16
  - 6. Surface Texture: Fine-textured, non-perforated and non-fissured.
  - 7. Noise Reduction Coefficient (NRC): 0.75
  - 8. Ceiling Attenuation Class: 35, minimum

9. Sound Blocking: up to 40
10. Light Reflectance: 88%
11. Sag/humidity Resistance: HUMIGUARD Plus Standard
12. Flame Spread: ASTM E 1264; Class A (UL)

- E. Acoustical Panels (ACT-3): with the following characteristics:
1. Basis of Design: Armstrong Kitchen Zone Lay-In
  2. Color: White.
  3. Size: 24-inch x 24-inch.
  4. Thickness: 5/8-inch.
  5. Edge: Prelude 15/16
  6. Surface Texture: Fine-textured, non-perforated and non-fissured.
  7. Noise Reduction Coefficient (NRC): 0.75.
  8. Ceiling Attenuation Class: 33, minimum
  9. Sound Blocking: up to 40.
  10. Light Reflectance: 88%.
  11. Sag/Humidity Resistance: HUMIGUARD Plus Standard
  12. Flame Spread: ASTM E84; Class A (UL)

### **2.03 SUSPENSION SYSTEM(S)**

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
1. Profile: Tee; 15/16 inch face width.
  2. Finish: Baked Enamel.
  3. Color: White.
  4. Refer to manufacturer for recommended suspension type for application.

### **2.04 ACCESSORIES**

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Perimeter Moldings: Same metal and finish as grid.
- D. Touch-up Paint: Type and color to match acoustical and grid units.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

### **3.02 PREPARATION**

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

### **3.03 INSTALLATION - SUSPENSION SYSTEM**

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.



- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.
- E. Suspension System, Non-Seismic: 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.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

#### **3.04 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
  - 1. Cut to fit irregular grid and perimeter edge trim.
  - 2. Make field cut edges of same profile as factory edges.
  - 3. Double cut and field paint exposed reveal edges.

#### **3.05 TOLERANCES**

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

**END OF SECTION**

**SECTION 09 5426**  
**SUSPENDED WOOD CEILINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Wood veneer panels.
- B. Linear wood planks.
- C. Metal suspension system.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 5100 - Acoustical Ceilings: Metal suspension systems.

**1.03 REFERENCE STANDARDS**

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- D. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.
- E. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- G. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2020.
- H. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2022.
- I. CISCA (WC) - Wood Ceilings Technical Guidelines; 2009.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Sequence work to ensure ceilings are not installed until building is enclosed, dust generating activities have terminated, and overhead work is completed.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, attachment of wood ceiling components to grid, accessory attachments, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
- C. Product Data: Provide data on wood ceiling components and suspension system components.
- D. Samples: Submit two full size samples illustrating material and finish of wood ceiling components.
- E. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements for additional provisions.

**1.06 QUALITY ASSURANCE**

- A. Designer Qualifications for Seismic Design: Perform design under direct supervision of Professional Structural Engineer experienced in design of this type of work and licensed in Nevada.

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with at least three years documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver wood ceiling components to project site in original, unopened packages.
- B. Store in fully enclosed space, flat, level and off the floor.

#### **1.08 FIELD CONDITIONS**

- A. Do not install suspended wood ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.
- B. Maintain room temperature between 60 degrees F and 75 degrees F and relative humidity between 35 to 55 percent before, during, and after installation.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Suspended Wood Ceilings:
  - 1. Armstrong World Industries, Inc; Woodworks: [www.armstrongceilings.com/#sle](http://www.armstrongceilings.com/#sle).
  - 2. OGB Architectural Ceilings (A division of OGB Architectural Millwork); <https://www.ogb-am.com/>
  - 3. Rulon International: [www.rulonco.com/#sle](http://www.rulonco.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 SUSPENDED WOOD CEILING SYSTEM**

- A. Performance Requirements:
  - 1. Design for maximum deflection of 1/360 of span.
- B. Linear Wood Veneered Planks Type CL-1: Composite wood core with wood veneer finish.
  - 1. Plank Size: 96 by 3 3/4 inches.
  - 2. Panel/Plank Thickness: 3/4 inch.
  - 3. Veneer Species: Maple.
    - a. Factory Finish: As scheduled.
  - 4. Acoustical Fabric: Manufacturer's standard non-woven fabric.
  - 5. Edge Profile: Square.
  - 6. Suspension System: Type specified below.
  - 7. Products:
    - a. Armstrong: Woodworks Linear Veneered Planks: [www.armstrongceilings.com](http://www.armstrongceilings.com).
    - b. OGB Architectural Ceilings (A division of OGB Architectural Millwork) Linear Veneer Plank: <https://www.ogb-am.com/>
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- C. Metal Suspension System:
  - 1. General: Comply with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
    - a. Materials:
      - 1) Aluminum Grid: Aluminum sheet, ASTM B209/B209M.
  - 2. Concealed Ceiling Suspension System: Aluminum grid.
    - a. Description: Engineered grid, with slotted faces in main tees, cross tees, hangers, trim molding, load resisting struts, hinge assemblies, and other suspension components required to support ceiling and other ceiling supported construction. Panels installed from below by inserting torsion springs into slots in faces of main tees of ceiling grid.
    - b. Application(s): Downward access.
    - c. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.

- d. Profile: Flat.
- e. Finish: Powder coat.
- f. Color: Black.
- 3. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement.
- D. Accessories: Manufacturer's standard accessories for installation method indicated, seismic requirements and above-ceiling accessibility.

### **2.03 FABRICATION**

- A. Shop fabricate wood ceiling components to the greatest extent possible.
- B. Fabricate components to allow access to ceiling plenum as required.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Do not install ceiling until after interior wet work is dry.

### **3.02 PREPARATION**

- A. Coordinate the location of hangers with other work.
- B. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.
- C. Layout wood ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.
- D. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of 48 hours prior to installation.

### **3.03 INSTALLATION**

- A. General: Install suspended wood ceiling system in accordance with CISCA (WC).
- B. Suspension System:
  - 1. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
  - 2. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
  - 3. 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.
  - 4. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
  - 5. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
  - 6. Do not eccentrically load system or induce rotation of runners.
- C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
- D. Wood Ceiling:
  - 1. Install wood ceilings in accordance with manufacturer's instructions.
  - 2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.
  - 3. Install components in uniform plane, and free from twist, warp, and dents.
  - 4. Cut to fit irregular grid and perimeter edge trim.
  - 5. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.

**3.04 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

**3.05 CLEANING**

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

**END OF SECTION**

**SECTION 09 5433**  
**LINEAR POLYMER CEILINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Suspended metal ceiling grid system and perimeter trim.
- B. Linear, engineered formed polymer ceiling and soffit panels.

**1.02 RELATED REQUIREMENTS**

- A. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads.
- B. Section 26 5600 - Exterior Lighting: Light fixtures.

**1.03 DESIGN REQUIREMENTS**

- A. Design components to ensure light fixtures will not induce eccentric loads. Where components may induce rotation of ceiling system components, provide stabilizing reinforcement.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate work of this section with installation of mechanical and electrical components and with other construction activities affected by work of this section.
- B. Preinstallation Meeting: Convene one week before starting work of this section.
- C. Sequencing: Supply hanger clips during steel deck erection. Supply additional hangers and inserts as required.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Furnish for component profiles.
- C. Shop Drawings: Indicate reflected ceiling plan.
- D. Samples: Submit two samples 4 by 8 inch in size illustrating color and finish of exposed to view components.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Linear Panels: Ten, standard lengths of #90 Amber Bamboo and one standard length of #50 Dark Cherry.

**1.06 QUALITY ASSURANCE**

- A. Designer Qualifications for Seismic Design: Under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at Nevada.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section.
  - 1. Approved by metal ceiling manufacturer.
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.
- B. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

**1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty; include coverage for discoloration of surface finish.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Engineered Polymer Canopy Ceiling System:
  - 1. Basis of Design; CL-5, Rulon International: Endure Woodgrain 400: [www.rulonco.com](http://www.rulonco.com).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 LINEAR POLYMER CEILING**

- A. Linear Polymer Ceiling and Soffit System: Panels, suspension members, trim and accessories as required to provide a complete system.
- B. Performance Requirements:
  - 1. Design to support imposed loads of indicated items without eccentric loading of supports.
  - 2. Design for maximum deflection of 1/360 of span.
  - 3. Systems Located Outside of Building Envelope and within Vestibules:
    - a. Accommodate wind and suction loads and wind uplift without damage in accordance with applicable code.

### **2.03 COMPONENTS**

- A. Linear Panels:
  - 1. Material: Engineered polymer extrusions with embossed finish.
  - 2. Profile: rectangular shape with integrated spacer, 8 inch by 3/4 inch nominal.
  - 3. Edge: Square.
  - 4. Length: Equal.
  - 5. Sight-exposed Surface Finish: embossed woodgrain finish; from manufacturer's standard range.
- B. Edge Molding, Expansion Joints, and Splices: Same material, thickness, and finish as linear panels.
- C. End Caps: Molded plastic; same color and finish as sight-exposed surfaces of linear panels.
- D. Accessories: Stabilizer bars as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.
- E. Suspension Members: Formed steel sections, with integral attachment points; galvanized finish; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- F. Suspension Wire: Size and type as required for application, seismic requirements, and ceiling system flatness requirement specified.
- G. Subgirt Members: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating; formed to resist imposed loads and to provide attachment for linear panels and accessories.

### **2.04 FABRICATION**

- A. Shop or field cut linear panels as recommended by manufacturer to accommodate mechanical and electrical items.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Verify that field measurements are as indicated.

### **3.02 INSTALLATION**

- A. Suspension Components:

1. Install after above-ceiling work is complete in accordance with manufacturer's instructions, ASTM C636/C636M, and ASTM E580/E580M.
  2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.
  3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.
  4. Locate suspension system for linear panel layout parallel to building lines according to reflected plan.
- B. Linear Panels:
1. Install linear panels and other system components in accordance with manufacturer's instructions.
  2. Field miter corners at changes in panel direction.
  3. Install space closures between linear panels at interior locations.
  4. Install edge moldings at junctions with other finishes and at vertical surfaces; use maximum piece lengths.
  5. Exercise care when site cutting sight-exposed finished components to ensure surface finish is not defaced.

### **3.03 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.
- C. Maximum Variation From Dimensioned Position: 1/4 inch.

### **3.04 CLEANING**

- A. Clean woodgrain embossed surfaces.
- B. Replace damaged or abraded components.

**END OF SECTION**



**SECTION 09 6500  
RESILIENT FLOORING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Luxury Vinyl Tile flooring
- B. Resilient base.
- C. Installation accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

**1.03 REFERENCE STANDARDS**

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.
- C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2018).
- D. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing; 2004 (Reapproved 2021).
- E. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.
- F. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
- G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2019.
- H. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- E. Verification Samples: Submit two samples, 12 by 12 inch (305 by 305 mm) in size illustrating color and pattern for each resilient flooring product specified.
- F. Concrete Testing Standard: Submit a copy of ASTM F710.
- G. Moisture Test Results must be submitted to the Flooring Distributor prior to delivery and installation of resilient sheet flooring.
- H. Do not install when the moisture vapor emission rate (MVER) exceed 5lbs. per 1,000 sq.ft. per 24 hours, when using the anhydrous calcium chloride test (ASTM F1869). MVER must be diminishing over time. Do not install when the relative humidity (RH) of the concrete slab exceeds 80% (ASTM F2170).
- I. Concrete pH must exceed 9. Perform test and submit results to Flooring Distributor.
- J. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- K. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

- L. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Flooring Material: 40 square feet (3.7 square meters) of each type and color.
  - 3. Extra Wall Base: 20 linear feet (6 linear meters) of each type and color.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
- D. Deliver materials to project site in manufacturer's original, unopened containers with labels indicating brand names, colors and patterns, and quality designations legible and intact.
- E. Store and protect materials in accordance with manufacturer's recommendations.
- F. Do not store luxury vinyl planks on their sides or edges prior to installation. Cartons must remain flat during acclimation to insure proper dimensional stability during installation.
- G. Protect roll materials from damage by storing on end.
- H. Do not double stack pallets.

#### **1.07 FIELD CONDITIONS**

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

#### **1.08 QUALITY ASSURANCE**

- A. Provide each type of resilient sheet flooring and accessories from a manufacturer, including recommended primers, adhesives, sealants and leveling compounds.

#### **1.09 EXTRA MATERIALS**

- A. Furnish one percent for each color installed.

#### **1.10 WARRANTY**

- A. Twelve (12) year limited warranty commencing on date of substantial completion.

### **PART 2 PRODUCTS**

#### **2.01 TILE FLOORING**

- A. Luxury Vinyl Tile: Surface-decorated, with wear layer, directional wood-grained cushioned high performance luxury vinyl:
  - 1. Manufacturers:
    - a. TAJ Flooring; Phoenix Luxury Vinyl Planks and Tiles: [www.tajflooring.com/#sle](http://www.tajflooring.com/#sle).
    - b. Substitutions: See Section 01 6000 - Product Requirements.
  - 2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
  - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
  - 4. Static Load: ASTM F970 1500 psi.
  - 5. Antimicrobial: FlorSept
  - 6. Slip Resistance: ASTM D2048 >0.65

7. Residual Indentation: ASTM F1914 <8%
8. Resistance to Fungi: ASTM G21 - 0:fungi free
9. Antibacterial Activity: Resists the propagation of bacteria.
10. Plank Size: 7 by 48 inch (178 by 1219 mm).
11. Wear Layer Thickness: 22 mils.
12. Total Thickness: 4.5 mm, Non-cushioned.
13. Pattern: As indicated on drawings.
14. Color: As indicated on drawings.

B. See Finish and Material Schedules.

## **2.02 RESILIENT BASE**

- A. Resilient Base Type B-1: ASTM F1861, Type TP, rubber, thermoplastic; Group 1.
  1. Manufacturers:
    - a. Johnsonite, a Tarkett Company; Rubber Integral Base: [www.johnsonite.com](http://www.johnsonite.com).
    - b. Substitutions: See Section 01 6000 - Product Requirements.
  2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
  3. Height: 4 inch (102) mm.
  4. Thickness: 1/8 inch (3 mm) thick.
  5. Finish: Matte.
  6. Length: 8 ft lengths.
  7. Color: As indicated on drawings.
  8. Accessories: Premolded external corners and internal corners.

## **2.03 ACCESSORIES**

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Patching, Leveling, Underlayment: Mastic Latex type equivalent to Camps latex underlayment.
- D. Terminated Reducers: Manufacturer's standard; color as selected.
- E. Moldings, Transition and Edge Strips: Same material as flooring.
- F. Filler for Coved Base: Plastic.
- G. Adhesives: As recommended by manufacturer to suit floor covering products, type of traffic conditions expected, and substrate conditions indicated.
- H. Trowelable underlayments and patching compounds: cementitious formulation recommended by floor covering manufacturer for applications indicated, with minimum compressive strength of 3,500 psi.
- I. Sealer and Wax: Types recommended by flooring manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
  1. Test in accordance with ASTM F710.
  2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3. Slab substrates must be dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by floor covering manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.
- E. Do not allow resilient sheet flooring work to proceed until subfloor surfaces are satisfactory. Indicate adverse conditions of any type by letter to Architect and Flooring Distributor.
- F. Perform bond test at the rate of one per 50 square feet.

### **3.02 PREPARATION**

- A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).
- B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- C. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- D. Prohibit traffic until filler is fully cured.
- E. Remove all debris, sand, and other foreign materials or substances which may result in lack of adhesion, telegraphing or bleed through.
- F. Broom or vacuum clean substrates to be covered immediately before installation. Following cleaning, examine substrates to determine if there is any evidence of moisture, alkaline salts, carbonation or dust..

### **3.03 INSTALLATION - GENERAL**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-staining marking device.
- D. Spread only enough adhesive to permit installation of materials before initial set.
- E. Fit joints and butt seams tightly.
- F. Set flooring in place, press with heavy roller to attain full adhesion.
- G. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- H. Extend resilient sheet flooring into toe spaces, door reveals and into closets and similar openings.
- I. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
  1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
  2. Resilient Strips: Attach to substrate using adhesive.
- J. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- K. Flooring should be installed prior to use of any other items that may be necessary for installing on top of the finished floor.
- L. For glue-down installations scribe, cut and fit floor coverings to fit tightly to vertical surfaces, permanent fixtures, and built-in furniture such as cabinets, pipes, outlets, edgings,
- M. Install feature strips where indicated.
- N. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

### **3.04 INSTALLATION - TILE FLOORING**

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
- C. Find the center of the floor by marking vertical and horizontal lines across the floors at the center of the walls. Measure the squareness of the marked lines, and then begin to work from the center outwards, leaving a 0.12" expansion gap along the perimeter between the flooring and walls.

### **3.05 INSTALLATION - RESILIENT BASE**

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Miter internal corners. At external corners, use premolded units. 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.

### **3.06 CLEANING**

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

### **3.07 PROTECTION**

- A. Prohibit traffic on resilient flooring for 48 hours after installation. Do not allow rolling carts to be used on the floor for at least 72 hours.

**END OF SECTION**

**SECTION 09 6813  
TILE CARPETING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Carpet tile, fully adhered.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

**1.03 REFERENCE STANDARDS**

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016.
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019, with Editorial Revision (2020).
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
- E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- F. CRI 104 - Standard for Installation of Commercial Carpet; 2015.
- G. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Shop Drawings: Indicate layout of joints.
- D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Sustainable Design Submittal: Submit VOC content documentation for adhesives.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

## **1.06 FIELD CONDITIONS**

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Tile Carpeting: Refer to Material Schedule for manufacturer, types, sizes and locations.
- B. Basis of Design: Shaw Contract; [www.shawcontract.com](http://www.shawcontract.com).
  - 1. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 MATERIALS**

- A. Tile Carpeting: Tufted, manufactured in one color dye lot.

### **2.03 ACCESSORIES**

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Edge Strips: Embossed aluminum, anodized color.
- C. Adhesives:
  - 1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.
- D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
  - 1. Test as Follows:
    - a. Alkalinity (pH): ASTM F710.
    - b. Internal Relative Humidity: ASTM F2170.
    - c. Moisture Vapor Emission: ASTM F1869.
  - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.

### **3.03 INSTALLATION**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.

- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

**3.04 CLEANING**

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

**END OF SECTION**



**SECTION 09 8430**  
**SOUND-ABSORBING WALL AND CEILING UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Sound-absorbing ceiling baffles.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 9123 - Interior Painting.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.
- D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.
- E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.
- F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.
- B. Store units flat, in dry, well-ventilated space; do not stand on end.
- C. Protect edges from damage.

**PART 2 PRODUCTS**

**2.01 FABRIC-COVERED SOUND-ABSORBING UNITS**

- A. Manufacturers:
  - 1. BASIS OF DESIGN: DECOUSTICS : [decoustics.com](http://decoustics.com): Fabric Baffle Type 30 , AirRenew - Harmony Series. Custom shape as shown in drawings - Color TBD.
- B. Sound Absorbing Units: Prefinished, factory assembled fabric-covered panels.
  - 1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- C. Fabric-Covered Acoustical Ceiling Baffles:
  - 1. Baffle Core: Manufacturer's standard core.
  - 2. Custom Baffle size per drawings.
  - 3. Corners: Square.
  - 4. Color: As selected by Architect from manufacturer's full range.

**2.02 FABRICATION**

- A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.

- B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

### **2.03 ACCESSORIES**

- A. Ceiling-Suspended Accessories: Manufacturer's standard accessories at locations as indicated on each acoustical unit, sized appropriately for weight of acoustical unit.
- B. D-Ring Wire Suspension per manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.
- B. Suspend ceiling baffles at locations and heights as indicated.

### **3.03 CLEANING**

- A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

### **3.04 PROTECTION**

- A. Provide protection of installed acoustical panels until Date of Substantial Completion.
- B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

**END OF SECTION**

**SECTION 09 9113  
EXTERIOR PAINTING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
  - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
  - 2. Exposed surfaces of steel lintels and ledge angles.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
  - 6. Marble, granite, slate, and other natural stones.
  - 7. Floors, unless specifically indicated.
  - 8. Ceramic and other types of tiles.
  - 9. Exterior insulation and finish system (EIFS).
  - 10. Glass.
  - 11. Concealed pipes, ducts, and conduits.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 9123 - Interior Painting.

**1.03 DEFINITIONS**

- A. Comply with ASTM D16 for interpretation of terms used in this section.

**1.04 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2019.
- C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.
- D. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application; 2018.
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- F. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- G. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
- H. SSPC-SP 13 - Surface Preparation of Concrete; 2018.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
  - 3. Label each container with color in addition to the manufacturer's label.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.

#### **1.07 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 and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

#### **1.08 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

- B. Paints:
  - 1. Dunn-Edwards Paints; [www.dunnedwards.com](http://www.dunnedwards.com)
  - 2. Behr Process Corporation: [www.behr.com](http://www.behr.com).
  - 3. Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com).
- C. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
  - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
  - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
  - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

## **2.03 PAINT SYSTEMS - EXTERIOR**

- A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete and primed metal.
  - 1. Two top coats and one coat primer.
- B. Transparent Finish on Concrete Floors:
  - 1. 1 coat stain.
  - 2. Stain: Semi-Transparent Stain for Concrete Floors.
  - 3. Sealer: Water Based Sealer for Concrete Floors.
- C. Ferrous Metals, Unprimed, Alkyd, 3 Coat:
  - 1. One coat of alkyd primer.
  - 2. Gloss: Two coats of alkyd enamel.
  - 3. Semi-gloss: Two coats of alkyd enamel.
- D. Ferrous Metals, Primed, Alkyd, 2 Coat:
  - 1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
  - 2. Gloss: Two coats of alkyd enamel.
  - 3. Semi-gloss: Two coats of alkyd enamel.
- E. Pavement Marking Paint:
  - 1. Yellow: Two coats, with reflective particles.
  - 2. White: Two coats, with reflective particles.
  - 3. Red: Two coats, with "NO PARKING FIRE LANE" white letters.

## **2.04 PRIMERS**

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
  - 1. Interior/Exterior Quick Dry Alkyd Primer for Metal.

2. Rust-Inhibitive Water Based Primer.

## **2.05 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  1. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
  2. Concrete Floors and Traffic Surfaces: 8 percent.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:
  1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
  2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi at 6 to 12 inches. Allow to dry.
  3. Clean concrete according to ASTM D4258. Allow to dry.
  4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- H. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- I. Ferrous Metal:
  1. Solvent clean according to SSPC-SP 1.
  2. Shop-Primed 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. Re-prime entire shop-primed item.
  3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

### **3.03 APPLICATION**

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.
- E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

### **3.05 CLEANING**

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

### **3.06 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION**

**SECTION 09 9123  
INTERIOR PAINTING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
  - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
  - 2. Mechanical and Electrical:
    - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
    - b. In finished areas, paint shop-primed items.
    - c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
  - 6. Floors, unless specifically indicated.
  - 7. Ceramic and other tiles.
  - 8. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
  - 9. Glass.
  - 10. Acoustical materials, unless specifically indicated.
  - 11. Concealed pipes, ducts, and conduits.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 9113 - Exterior Painting.

**1.03 DEFINITIONS**

- A. Comply with ASTM D16 for interpretation of terms used in this section.

**1.04 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2019.
- C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.
- D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- F. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).
- G. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1; 2016.



- H. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- I. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
  - 2. MPI product number (e.g., MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
  - 4. Manufacturer's installation instructions.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
  - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
  - 3. Label each container with color in addition to the manufacturer's label.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.

#### **1.07 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 and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

#### **1.08 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
  - 1. Behr Process Corporation: [www.behr.com](http://www.behr.com).
  - 2. Dunn-Edwards Paints; [www.dunnedwards.com](http://www.dunnedwards.com).
  - 3. Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com).
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
  - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
  - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
  - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- E. Colors: As indicated on drawings.
  - 1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
  - 2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.
  - 3. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the drawings.

### **2.03 PAINT SYSTEMS - INTERIOR**

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, and uncoated steel.
  - 1. Two top coats and one coat primer.
- B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
  - 1. Medium duty applications include doors and door frames.
  - 2. Two top coats and one coat primer.
- C. Medium Duty Vertical and Overhead: Including gypsum board, uncoated steel, and shop primed steel.
  - 1. Two top coats and one coat primer.

- D. Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
  - 1. Shop primer by others.
  - 2. Two top coats.
  - 3. Top Coat: Latex Dry Fall.
- E. Transparent Finish on Concrete Floors.
  - 1. Sealer: Water Based Sealer for Concrete Floors.
- F. Ferrous Metals, Unprimed, Latex, 3 Coat:
  - 1. One coat of latex primer.
  - 2. Gloss: Two coats of latex enamel.
  - 3. Semi-gloss: Two coats of latex enamel.
- G. Paint MI-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
  - 1. Touch-up with latex primer.
  - 2. Gloss: Two coats of latex enamel.
  - 3. Semi-gloss: Two coats of latex enamel.
- H. Gypsum Board/Plaster, Latex, 3 Coat:
  - 1. One coat of alkyd primer sealer.
  - 2. Gloss: Two coats of latex enamel.
- I. Gypsum Board/Plaster, Latex-Acrylic, 2 Coat:
  - 1. One coat of alkyd primer sealer.
  - 2. Gloss: One coat of latex-acrylic enamel.

#### **2.04 PRIMERS**

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

#### **2.05 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
  - 1. Gypsum Wallboard: 12 percent.
  - 2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
  - 3. Concrete Floors and Traffic Surfaces: 8 percent.

#### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.

- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Concrete:
  - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
  - 2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi at 6 to 12 inches. Allow to dry.
  - 3. Clean concrete according to ASTM D4258. Allow to dry.
- G. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- I. Galvanized Surfaces:
- J. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed 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. Re-prime entire shop-primed item.
  - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- K. Wood Surfaces to Receive Opaque 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. Back prime concealed surfaces before installation.
- L. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

### **3.03 APPLICATION**

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

### **3.05 CLEANING**

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

### **3.06 PROTECTION**

- A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION**

## SECTION 10 1400

### SIGNAGE

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Interior Room and door signs.
- B. Emergency evacuation maps.
- C. Building identification signs.
- D. Exterior Signage

##### 1.02 RELATED REQUIREMENTS

- A. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- B. Section 26 0553 - Identification for Electrical Systems.

##### 1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

##### 1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
  - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
  - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect As early as possible in the construction process; upon request, submit preliminary schedule. Refer to Section 01 3000 for required turn-around time for submittals.
  - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Verification Samples: Submit samples showing colors specified.
- G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.

##### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years of documented experience.
- B. Installer Qualifications: Minimum 5 years of documented experience in work of this section.
- C. Single Source Requirements: Obtain all products in this section from a single supplier.
- D. Mock-Up: As requested by architect, provide a mock-up of select sign types for evaluation of finishes and application workmanship.
  - 1. Finishes designated in shop drawing and selected by Architect.

2. Do not proceed with remaining work until workmanship, color and finish are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays. Thoroughly inspect products upon receipt.
- B. Deliver products in manufacturer's original, unopened, undamaged containers and packaging with labels clearly identifying product name and manufacturer intact.
- C. Store products protected from weather, temperature and other harmful conditions in accordance with manufacturer's instructions.
- D. Package signs as required to prevent damage before installation.
- E. Package room and door signs in sequential order of installation, labeled by floor or building.
- F. Store tape adhesive at normal room temperature.

#### **1.07 FIELD CONDITIONS**

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

#### **1.08 WARRANTY**

- A. Provide written documentation of manufacturer's warranty.
  1. Warranty must guarantee interior signs for the life of the building.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Flat Signs:
  1. Century Sign Builders, 2117 Commercial NE: Albuquerque, NM 87106 | (505) 888-2901 | hello@csbsigns.com | www.csbsigns.com
  2. Deluxe Design, 561 Quantum Road NE Albuquerque, NM 87124, (505) 892-8090, csr@deluxedesign.com, www.deluxedesign.com.
  3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Dimensional Letter Signs:
  1. Century Sign Builders, 2117 Commercial NE: Albuquerque, NM 87106 | (505) 888-2901 | hello@csbsigns.com | www.csbsigns.com.
  2. Deluxe Design, 561 Quantum Road NE Albuquerque, NM 87124, (505) 892-8090, csr@deluxedesign.com, www.deluxedesign.com.
  3. Substitutions: See Section 01 6000 - Product Requirements.
- C. Other Signs - as indicated on drawings:

#### **2.02 SIGNAGE APPLICATIONS**

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
  1. Sign Type: Flat signs with applied character panel media as shown on drawings.
  2. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
  3. See drawings for sign sizes and character heights.
  4. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.

5. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
  6. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
  7. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
- C. Emergency Evacuation Maps:
1. Provide and locate maps per the drawings.
  2. Map content to be provided by Owner.
  3. Use clear plastic panel silk-screened on reverse, in brushed aluminum frame, screw-mounted.
- D. Building Identification Signs:
1. Use individual metal letters.
  2. Mount on outside wall in location indicated on drawings.
- E. Other Dimensional Letter Signs: Wall-mounted.
1. Interior: Allow for total of 50 letters, 6 inches (150 mm) high, metal.
- F. Traffic Signs: To match campus standards; locate where indicated on drawings.

### 2.03 SIGN TYPES

- A. Flat Signs: System by Deluxe Design.
1. General Characteristics
    - a. Regulatory Compliance: All signs shall conform to the requirements of regulations list in section 1.3 and shall be designed to meet the stated requirements for color, contrast, letter height, install location and other characteristics required for accessibility and by local, state and federal regulations.
    - b. Base material or chassis: Non-Glare plastic sign panel
      - 1) Colored non-glare acrylic multi-polymer by Rowmark plastics.
      - 2) Products with painted or otherwise applied coloration method are not acceptable.
      - 3) Finishes and color as per approved shop drawings.
    - c. Lens or cover material: lens and covers shall be constructed using 0.125" (342-101) or 0.0625" (322-101) clear single-ply non-glare acrylic multi-polymer (Rowmark),
    - d. Changeable message insert will be fabricated from commonly available transparency media no less than 5 mil thick that is compatible with inkjet or laser printers such as 3M CG3710 or equivalent.
    - e. Printed graphic inserts: Printed inserts will be created using a satin-coated, tear-resistant, rigid PVC media with eco-solvent waterfast & UV stable inks.
      - 1) Printed background inserts must be manufactured in color managed workflow with the following capacities:
        - (a) All printing must be done using a profiled printer with transmissible ICC profile.
        - (b) All approved colors used in final design must have LAB values recorded and submitted to architect owner for future reference and duplication.
        - (c) Printing must be performed on calibrated printer such that future orders of insert can be reproduced within 5 Delta E of recorded LAB values.
    - f. Tactile Raised Lettering/Graphic method: Tactile lettering and symbols shall be formed using rotary engraving method and bonded to sign plaque using 3M Scotch 467HP adhesive. Text, numbers and symbols must have 1/32" return cut to 22 degree angle. Text, numbers and symbols must be constructed with materials having embedded coloration that is the final approved color for the signs. Products with painted or otherwise applied coloration method are not acceptable.
    - g. Braille Method: Braille must be constructed using the Edgerton Grade 2 Braille System using clear Raster beads.



- h. Other Lettering Method: Permanent sign messages not requiring tactile lettering shall be formed using a reverse engraved method whereby letter forms are engraved from the second surface of a base substrate which is a clear material with a thin permanent layer of color on the rear (second) surface. Letter forms, reversed to read properly from the front, are engraved through the second surface to reveal the clear core and then paint-filled in an approved color.
- i. Other features:
  - 1) Snap-N-Place fasteners: as indicated on the shop drawings, provide flexible rubber fasteners to secure lenses over changeable message inserts to allow for tool-free update to changeable inserts. Patent pending design, Century Sign Builders.
  - 2) Stand-off fasteners: as indicated on the shop drawings, provide fine finished aluminum stand-off fasteners consisting of a top cap, through bolt and (optionally) a stand-off barrel.
  - 3) Allen bolt fasteners: as indicated on the shop drawings, provide Allen bolts to secure lenses over changeable message inserts.
- j. Installation method:
  - 1) Wall mounted signs: signs shall be mounted using double-sided vinyl foam tape (1/16" thickness), silicon adhesive or mechanical anchors as per the approved shop drawings.
  - 2) Flag mount hardware: provide custom mounting bracket for flag mounted signs as indicated on shop drawings.
  - 3) Wall mount hardware: provide custom mounting hardware for wall mounted signs as indicated on shop drawings.
  - 4) Suspended mount hardware: provide custom mounting hardware for ceiling suspended mounted signs as indicated on shop drawings.
  - 5) Free standing hardware: provide base plate and floor fasteners (optional) for free standing signs as indicated on the shop drawings.
  - 6) Cubicle mounted hardware: provide removable mounting method for mounting sign at cubicles, workstations or systems furniture partitions as indicated on the shop drawings.
  - 7) Work surface hardware: provide angle bottom flange or stand to allow signs to be displayed in a vertical (slightly angled) fashion when placed on transaction counters, desks, etc. as indicated on the shop drawings.
  - 8) Sidelight mounted signs: Shall be mounted on top of first surface applied opaque vinyl graphic film (2 mil thickness) using double-sided vinyl foam tape (1/16" thickness), per the approved shop drawings.

- B. Color and Font: Unless otherwise indicated:
  - 1. Character Font: Helvetica, Arial, or other sans serif font.
  - 2. Character Case: Upper case only.
  - 3. Background Color: Clear.
  - 4. Character Color: Contrasting color.

#### **2.04 TACTILE SIGNAGE MEDIA**

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
  - 1. Total Thickness: 1/16 inch (1.6 mm).
- B. Applied Character Panels: Acrylic plastic base, with applied acrylic plastic letters and braille.
  - 1. Total Thickness: 1/8 inch (3 mm).
  - 2. Letter Thickness: 1/8 inch (3 mm).
  - 3. Letter Edges: Square.

#### **2.05 NON-TACTILE SIGNAGE MEDIA**

- A. Silk Screened Plastic Panels: Letters and graphics silk screened onto reverse side of plastic surface:

1. Sign Color: Clear.
2. Total Thickness: 1/8 inch (3 mm).

## **2.06 DIMENSIONAL LETTERS**

- A. Metal Letters:
  1. Metal: Aluminum casting.
  2. Metal Thickness: Manufacturer's standard for letter size.
  3. Letter Height: 12 inches (305 mm).
  4. Text and Typeface:
    - a. Character Font: Helvetica, Arial, or other sans serif font.
    - b. Character Case: Upper case only.
  5. Finish: As selected by Architect from manufacturer's full range.
  6. Mounting: Concealed screws.

## **2.07 ACCESSORIES**

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs where indicated:
  1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches (1525 mm) above finished floor.
  2. Locate on wall at latch side of door.
  3. Raised characters shall be 48" minimum above finished floor, measured to the baseline of the lowest raised character.
  4. Raised characters shall be 60" maximum above finished floor measured to the baseline of the highest raised character.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

**END OF SECTION**

**SECTION 10 2113.17**  
**PHENOLIC TOILET COMPARTMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Phenolic toilet compartments.
- B. Urinal screens.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Blocking and supports.
- B. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

**1.03 REFERENCE STANDARDS**

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- D. Samples: Submit two samples of partition panels, 6 by 6 inch in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Phenolic Toilet Compartments:
  - 1. All American Metal Corp - AAMCO: [www.allamericanmetal.com/#sle](http://www.allamericanmetal.com/#sle).
  - 2. ASI Accurate Partitions: [www.asi-accuratepartitions.com/#sle](http://www.asi-accuratepartitions.com/#sle).
  - 3. ASI Global Partitions: [www.asi-globalpartitions.com/#sle](http://www.asi-globalpartitions.com/#sle).
  - 4. Partition Systems International of South Carolina; Phenolic Toilet Partitions: [www.psisc.com/#sle](http://www.psisc.com/#sle).
  - 5. Substitutions: Section 01 6000 - Product Requirements.

**2.02 PHENOLIC TOILET COMPARTMENTS**

- A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted headrail-braced.
- B. Doors:
  - 1. Thickness: 3/4 inch.
  - 2. Width: 24 inch.
  - 3. Width for Handicapped Use: 36 inch, out-swinging.
  - 4. Height: 58 inch.
- C. Panels:
  - 1. Thickness: 1/2 inch.
  - 2. Height: 58 inch.
  - 3. Depth: As indicated on drawings.

- D. Pilasters:
  - 1. Thickness: 3/4 inch.
  - 2. Width: As required to fit space; minimum 3 inch.
- E. Screens: Without doors; to match compartments; mounted to wall with two panel brackets with vertical support/bracing same as compartments.

### **2.03 ACCESSORIES**

- A. Pilaster Shoes: Formed ASTM A666, Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings.
- B. Head Rails: Hollow anodized aluminum, 1 inch by 1-1/2 inch size, with anti-grip profile and cast socket wall brackets.
- C. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
- D. Hardware: Polished stainless steel:
  - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
  - 2. Door Latch: Slide type with exterior emergency access feature.
  - 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
  - 4. Coat hook with rubber bumper; one per compartment, mounted on door.
  - 5. Provide door pull for outswinging doors.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

### **3.02 INSTALLATION**

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

### **3.03 TOLERANCES**

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

### **3.04 ADJUSTING**

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

### **3.05 SCHEDULES**

- A. Womens 416: Three toilet stalls of floor mounted, head rail braced type; colors as selected.
- B. Mens 415: Two toilet stalls of floor mounted, head rail braced type; two urinal screens with pilaster bracing; colors as selected.
- C. Womens 517: Three toilet stalls of floor mounted, head rail braced type; colors as selected.
- D. Mens 516: Two toilet stalls of floor mounted, head rail braced type; colors as selected.

**END OF SECTION**



**SECTION 10 2240**  
**VERTICALLY FOLDING OPERABLE WALLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Automatic Vertically Retractable Accoustic Walls
- B. Necessary hardware, seals, lifting machinery and electrical controls.
- C. Electric operator.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 1000 - Structural Steel: Overhead structural support framing.
- B. Section 26 0533.13 - Conduit for Electrical Systems: Empty conduit from partition motor controller to disconnect and from motor controller to control buttons.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- C. ASTM E413 - Classification for Rating Sound Insulation; 2016.
- D. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions; 2012.
- E. ASTM E596 - Standard Test Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures; 1996 (Reapproved 2016).
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on partition materials, operation, hardware and accessories, electric operating components, and colors and finishes available.
- C. Shop Drawings: Indicate opening sizes, static and dynamic loads, location and details of pass door and frame, adjacent construction and finish trim, and details of required supports.
- D. Samples for Selection: Submit two samples of full manufacturer's color range for selection of colors.
- E. Samples for Review: Submit two samples of surface finish, 12 by 12 inches size, illustrating quality, colors selected, texture, and weight.
- F. Certificates: Certify that partition system meets or exceeds specified acoustic requirements.
- G. Manufacturer's Instructions: Indicate special procedures.
- H. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified this section with minimum three years of documented experience.
- B. The operable wall must be manufactured by a certified ISO-9001-2008 company or an equivalent quality control system.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Manufacturers of Automatic Vertically Retractable Acoustic Walls:
  - 1. Skyfold Inc. of Montreal Canada (514) 457-4767, Basis of Design is Skyfold Zenith 51, [www.skyfold.com](http://www.skyfold.com).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 COMPONENTS**

- A. Fully Automatic Operable Wall: Vertically opening; accordian folding panels; motor operated.
  - 1. Panel Finish: Fabric from floor to 26.5" and from 79.5" to 132".
  - 2. Panel Finish: White Marker Board from 26.5" above floor to 79.5" above floor.
  - 3. Sound Transmission Class (STC): 48-52 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft.
  - 4. Surface Burning Characteristics of Panel Finish: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
  - 5. Installed operable wall system to structure overhead capable of supporting imposed dead load of the wall, with maximum deflection of 1/360 of span.
- B. Panel Construction:
  - 1. Panel Substrate Facing: Steel sheet.
  - 2. Panels shall be fabricated to be as stiff and flat as possible in order to satisfy the rigid criteria when operable wall is down in closed position and while moving.
- C. Core: Structural and extruded aluminum construction utilizing manufacturer's standard fabrication methods.
- D. Wall Panel Assembly: thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction, with acoustical insulation fill.
  - 1. Thickness without Finish: 11 3/4" inches.
  - 2. Weight of Assembly: 6.0 Lbs per sq ft not including finishes or motor operator.
- E. Acoustic Seals: Retractable acoustic seals at jambs. Flexible acoustic seals at ceilings, floor, and above door to wall enclosure to deck.

### **2.03 ELECTRICAL CHARACTERISTICS AND COMPONENTS**

- A. Electrical Characteristics:
  - 1. 3/4 or 1 hp, 20 amp rated load amperes.
  - 2. 208 volts, three phase, 60 Hz.
- B. Electric Operator: 1.2 inches per second travelling speed; electromagnetic brake for stopping door due to obstructions or normal operations and a separate dynamic brake for stopping door due to loss of power or catastrophic failure of the operating system.
- C. Control Station: One standard keyed with constant pressure type push button and one with constant pressure type push button only, 24 volt circuit; recess mounted at opposite ends of door and on opposite sides of wall.
  - 1. Furnish 4 keys.
- D. Conduit and Outlet Boxes: Surface type in accordance with Section 26 0533.13.
- E. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
- F. Disconnect Switch: Factory mount disconnect switch in control panel.
- G. Limit Switches: Automatic type, at both extremes of travel, to prevent over-travel.
- H. Emergency Release: Mechanism to disengage motor drive system and permit manual operation.

- I. Obstruction Sensors: Bottom edge of wall to be equipped with an obstruction sensor that runs the entire length of the wall. Wall shall stop and reverse direction for 3 seconds and stop if obstruction is encountered.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that required utilities are available, of the correct characteristics, in proper location, and ready for use.
- C. Verify track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.
- D. Verify floor flatness of 1/8 inch in 10 feet, non-cumulative.

#### **3.02 INSTALLATION**

- A. Install partition in accordance with manufacturer's instructions and ASTM E557.
- B. Install electric operator, wiring, and controls. Locate control station(s) as indicated.
- C. Fit and align partition assembly and pocket doors level and plumb.
- D. Lubricate moving components.
- E. Install acoustic sealant to achieve required acoustic performance.
- F. Coordinate electrical connections.

#### **3.03 ADJUSTING**

- A. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.
- B. Adjust partition assembly to achieve lightproof seal.

#### **3.04 CLEANING**

- A. Clean finish surfaces and partition accessories.

#### **3.05 CLOSEOUT ACTIVITIES**

- A. Demonstrate operation of partition and identify potential operational problems.

#### **3.06 SCHEDULES**

- A. Conference Room 310: Vertically Retractable Wall, electric operation, floor to ceiling height 10'-0", STC of 48, marker board surface from 26 1/2" to 79 1/2" above floor, fabric surface above and below, both surfaces/sides the same.

**END OF SECTION**



**SECTION 10 2601**  
**WALL AND CORNER GUARDS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Corner guards.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Blocking for wall and corner guard anchors.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.
- C. Samples: Submit two sections of bumper rail, 24 inch (600 mm) long, illustrating component design, configuration, color and finish.
- D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Wall and Corner Guards:
  - 1. Inpro; Bumper/Crash Rail 700, Chair Rail 2500, Corner Guards 150, Corridor Handrails 800: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  - 2. Babcock-Davis: [www.babcockdavis.com/sle](http://www.babcockdavis.com/sle).
  - 3. Construction Specialties, Inc: [www.c-sgroup.com](http://www.c-sgroup.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 COMPONENTS**

- A. Corner Guards - Surface Mounted: Inpro Model 150.
  - 1. Material: High impact vinyl with full height extruded aluminum retainer.
  - 2. Performance: Resist lateral impact force of 100 lbs (445 N) at any point without damage or permanent set.
  - 3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
  - 4. Width of Wings: 3 inches (76 mm).
  - 5. Corner: Square.
  - 6. Color: As selected from manufacturer's standard colors.
  - 7. Projection From Wall to Outside of Guard: 3/8 inch (\_\_\_\_ mm).
  - 8. Length: One piece to extend from top of specified base to specified ceiling height.
  - 9. Preformed end caps.
- B. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

**2.03 FABRICATION**

- A. Fabricate components with tight joints, corners and seams.
- B. Form end trim closure by capping and finishing smooth.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

### **3.02 INSTALLATION**

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.
- B. Position corner guard from top of specified base to ceiling.

### **3.03 TOLERANCES**

- A. Maximum Variation From Required Height: 1/4 inch (6 mm).
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch (6 mm).

**END OF SECTION**

**SECTION 10 2800**  
**TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Under-lavatory pipe supply covers.
- D. Electric hand/hair dryers.
- E. Diaper changing stations.
- F. Utility room accessories.

**1.02 RELATED REQUIREMENTS**

**a.**

- A. Section 10 2113.19 - Plastic Toilet Compartments.
- B. Section 22 4000 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

**1.03 REFERENCE STANDARDS**

- A. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004, with Editorial Revision (2016).

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Commercial Toilet, Shower, and Bath Accessories:
  - 1. AJW Architectural Products: [www.ajw.com/#sle](http://www.ajw.com/#sle).
  - 2. American Specialties, Inc: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).
  - 3. Bradley Corporation: [www.bradleycorp.com/#sle](http://www.bradleycorp.com/#sle).
  - 4. Georgia-Pacific Professional: [www.blue-connect.com/#sle](http://www.blue-connect.com/#sle).
  - 5. Substitutions: Section 01 6000 - Product Requirements.
- B. Institutional Security and Ligation-Resistant Toilet and Bath Accessories:
  - 1. American Specialties, Inc: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).
  - 2. Whitehall Manufacturing: [www.whitehallmfg.com/#sle](http://www.whitehallmfg.com/#sle).
  - 3. Substitutions: Section 01 6000 - Product Requirements.
- C. Under-Lavatory Pipe Supply Covers:
  - 1. Plumberex Specialty Products, Inc: [www.plumberex.com/#sle](http://www.plumberex.com/#sle).
  - 2. Substitutions: Section 01 6000 - Product Requirements.
- D. Electric Hand/Hair Dryers:
  - 1. American Specialties, Inc: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).
  - 2. Excel Dryer: [www.exceldryer.com/#sle](http://www.exceldryer.com/#sle).
  - 3. Frost Products Limited: [www.frostproductsltd.com/#sle](http://www.frostproductsltd.com/#sle).
  - 4. Mitsubishi Electric Trane HVAC US LLC: [www.mitsubishielectric.com/#sle](http://www.mitsubishielectric.com/#sle).
  - 5. Stelpro Design Inc; ELN - El-Nino Hand Dryer: [www.stelpro.com/#sle](http://www.stelpro.com/#sle).
  - 6. World Dryer Corporation: [www.worlddryer.com/#sle](http://www.worlddryer.com/#sle).
  - 7. Substitutions: Section 01 6000 - Product Requirements.
- E. Diaper Changing Stations:
  - 1. American Specialties, Inc: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).
  - 2. Bradley Corporation: [www.bradleycorp.com/#sle](http://www.bradleycorp.com/#sle).
  - 3. Diaper Deck & Company: [www.diaperdeck.com/#sle](http://www.diaperdeck.com/#sle).
  - 4. Koala Kare Products: [www.koalabear.com/#sle](http://www.koalabear.com/#sle).
  - 5. Safe-Strap Company, Inc: [www.diaperdepot.com/#sle](http://www.diaperdepot.com/#sle).
  - 6. Substitutions: 01 6000 - Product Requirements.

## **2.02 COMMERCIAL TOILET ACCESSORIES**

- A. Toilet Paper Dispenser: Double roll, surface mounted bracket type, stainless steel, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
- B. Paper Towel Dispenser: Electric, roll paper type.
  - 1. Cover: Stainless steel.
  - 2. Paper Discharge: Touchless automatic.
  - 3. Capacity: 6 inch diameter roll.
  - 4. Mounting: Semi recessed.
  - 5. Power: Battery operated.
  - 6. Refill Indicator: Illuminated refill indicator.
- C. Automated Soap Dispenser: Liquid soap dispenser, wall-mounted, with stainless steel cover and window to gauge soap level, tumbler lock.
  - 1. Minimum Capacity: 48 ounces.
- D. Seat Cover Dispenser: Stainless steel, surface-mounted, reloading by concealed opening at base, tumbler lock.
  - 1. Minimum capacity: 250 seat covers.
- E. Grab Bars: Stainless steel, smooth surface.
  - 1. Standard Duty Grab Bars:
    - a. Push/Pull Point Load: 250 pound-force, minimum.
    - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
    - c. Finish: Satin.
    - d. Length and Configuration: As indicated on drawings.
- F. Combination Sanitary Napkin/Tampon Dispenser with Disposal: Stainless steel, surface-mounted.
- G. Mirrors: Stainless steel frames, ¼ inch (6mm) thick tempered safety glass; ASTM C1048.
  - 1. Size: As indicated in drawings.
  - 2. Frame: 0.05 inch (1.3 mm) angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
- H.

## **2.03 COMMERCIAL SHOWER AND BATH ACCESSORIES**

- A. Shower Curtain Rod: Stainless steel tube, 1 inch outside diameter, 0.04 inch wall thickness, satin-finished, with 3 inch outside diameter, minimum 0.04 inch thick satin-finished stainless steel flanges, for installation with exposed fasteners. Crescent shaped.
- B. Shower Curtain:
  - 1. Material: Opaque vinyl, 0.008 inch thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
  - 2. Color: As selected from manufacturer's standard colors.
- C. Folding Shower Seat: Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, and mechanical fasteners of Type 304 stainless steel, rectangular seat.
  - 1. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of color as selected.

## **2.04 UNDER-LAVATORY PIPE AND SUPPLY COVERS**

- A. Specified in 22 4000 - Plumbing Fixtures.

## **2.05 ELECTRIC HAND/HAIR DRYERS**

- A. Electric Hand Dryers: Traditional fan-in-case type, with downward fixed nozzle.
  - 1. Operation: Automatic, sensor-operated on and off.
  - 2. Mounting: Wall-mounted - surface.
  - 3. Cover: Plastic.

- a. Color: as selected by architect from manufactureres standard colors.
- b. Tamper-resistant screw attachment of cover to mounting plate.
- 4. Air Velocity: 18,000 linear feet per minute, minimum, at full power.
- 5. Heater: 500 W, minimum, at full power.
- 6. Fan/Heater Control: Field adjustable down to approximately half-speed with corresponding reduction in heat output.
- 7. Total Wattage: 1400 W, maximum.
- 8. Runtime: Field adjustable or automatic, up to 35 seconds.
- 9. Air sanitizing and deodorizing without use of chemicals.

## **2.06 DIAPER CHANGING STATIONS**

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
  - 1. Material: Polyethylene.
  - 2. Mounting: Surface.
  - 3. Color: As selected.
  - 4. Minimum Rated Load: 250 pounds.

## **2.07 UTILITY ROOM ACCESSORIES**

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
  - 1. Drying rod: Stainless steel, 1/4 inch diameter.
  - 2. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
  - 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
  - 4. Length: Manufacturer's standard length for number of holders/hooks.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.

### **3.02 PREPARATION**

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

### **3.03 INSTALLATION**

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

### **3.04 PROTECTION**

- A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION**

**SECTION 10 4400**  
**FIRE PROTECTION SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

**1.03 REFERENCE STANDARDS**

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
- B. FM (AG) - FM Approval Guide; current edition.
- C. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.
- D. UL (DIR) - Online Certifications Directory; Current Edition.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, and anchorage details.
- C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, locations of individual fire extinguishers, mounting measurements for wall bracket, and installation procedures.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

**1.05 FIELD CONDITIONS**

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fire Extinguishers:
  - 1. Ansul, a Tyco Business: [www.ansul.com](http://www.ansul.com).
  - 2. Amerex; [www.amerex-fire.com](http://www.amerex-fire.com).
  - 3. Kidde, a unit of United Technologies Corp: [www.kidde.com](http://www.kidde.com).
- B. Fire Extinguishers, Cabinets and Accessories:
  - 1. Ansul, a Tyco Business: [www.ansul.com](http://www.ansul.com).
  - 2. JL Industries, Inc: [www.jlindustries.com](http://www.jlindustries.com).
  - 3. Kidde, a unit of United Technologies Corp: [www.kidde.com](http://www.kidde.com).
  - 4. Larsen's Manufacturing Co: [www.larsensmfg.com](http://www.larsensmfg.com).
  - 5. Nystrom, Inc: [www.nystrom.com/sle](http://www.nystrom.com/sle).
  - 6. Amerex; [www.amerex-fire.com](http://www.amerex-fire.com)
  - 7. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 FIRE EXTINGUISHERS**

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
  1. Cartridge Operated: Spun shell.
  2. Class: A:B:C type.
  3. Size: 5 pound (2.27 kg).
  4. Finish: Baked polyester powder coat, red color.
  5. Temperature range: -4 degrees F (-20 degrees C) to 140 degrees F (60 degrees C).

### **2.03 FIRE EXTINGUISHER CABINETS**

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
- B. Fire Rated Cabinet Construction: One-hour fire rated.
- C. Cabinet Configuration: Semi-recessed type.
  1. Size to accommodate accessories.
  2. Trim: Flat rolled edge, with 2 inch (51 mm) wide face.
  3. Projected Trim: Returned to wall surface, with 3 inch (76 mm) projection, and 2 inch (\_\_\_\_ mm) wide face.
  4. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
- D. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.
- E. Door Handle: Recessed.
- F. Door Glazing: Acrylic plastic, clear, 1/8 inch (3 mm) thick, flat shape and set in resilient channel glazing gasket.
- G. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- H. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.
- I. Finish of Cabinet Interior: White colored enamel.

### **2.04 ACCESSORIES**

- A. Extinguisher Brackets: Formed steel, chrome-plated.
- B. Cabinet Signage: As selected.
- C. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 30 inches (762 mm) from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets and on wall brackets.

**END OF SECTION**

**SECTION 10 5100  
LOCKERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Phenolic lockers.

**1.02 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.
- D. Samples: Submit two samples 6 by 6 inches (152 by 152 mm) in size, of each color scheduled.
- E. Manufacturer's Installation Instructions: Indicate component installation assembly.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Protect locker finish and adjacent surfaces from damage.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Phenolic Lockers:
  - 1. Columbia Lockers, a division of PSiSC; Phenolic Lockers: [www.psisc.com/#sle](http://www.psisc.com/#sle).
  - 2. Summit Lockers; Phenolic Lockers: [www.summitlockers.com](http://www.summitlockers.com).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 PHENOLIC LOCKERS**

- A. Lockers: Factory assembled, made of phenolic core panels with mortise and tenon joints and stainless steel mechanical joint fasteners; fully finished inside and out; each locker capable of standing alone.
  - 1. Doors: Full overlay, covering full width and height of locker body; square edges.
  - 2. Panel Core Exposed at Edges: Machine polished, without chips or tool marks; square edge unless otherwise indicated.
  - 3. Where locker ends or sides are exposed, finish the same as fronts or provide extra panels to match fronts.
  - 4. Ventilation: By holes drilled in tops, bottoms, and intermediate shelves, and by open space between the back of door and locker body.
  - 5. Provide filler strips where indicated, securely attached to lockers.
  - 6. Door Color: To be selected by Architect.
  - 7. Body Color: Manufacturer's standard white or light color.
  - 8. Fasteners for Accessories and Locking Mechanisms: Tamperproof type.
- B. Component Thicknesses:
  - 1. Doors: 1/2 inch (13 mm) minimum thickness.
  - 2. Locker Body: One of the following combinations:
    - a. Tops, bottoms, and shelves 3/8 inch (10 mm); sides and backs 5/16 inch (8 mm); minimum.
    - b. Tops, bottoms, and shelves 1/2 inch (13 mm); sides 3/8 inch (10 mm); backs 1/4 inch (6 mm); minimum.
  - 3. End Panels and Filler Panels: 1/2 inch (13 mm) minimum thickness.
- C. Phenolic Core Panels: Nonporous phenolic resin and paper core formed under high pressure, with natural colored finished edges, integral melamine surface, matte finish, and uniform surface appearance; glued laminated panels not acceptable.



1. Surface Burning Characteristics: Flame spread index of 75 or less, and smoke developed index of 450 or less; when tested in accordance with ASTM E84.
- D. Hinges: Stainless steel, satin finish; minimum of 90 degree opening; either exposed barrel 5-knuckle hinge attached to back of door and inside of body with tamperproof screws, or completely concealed cabinetwork style hinge attached with tamperproof screws.
- E. Locks: Locker manufacturer's standard type of style indicated above.

**2.03 SEE DRAWINGS FOR CONFIGURATION.**

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases are properly sized.

**3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install lockers plumb and square.
- C. Place and secure on prepared base.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb (445 N).
- E. Bolt adjoining locker units together to provide rigid installation.
- F. Install end panels, filler panels, and sloped tops.
- G. Install accessories.
- H. Replace components that do not operate smoothly.

**3.03 CLEANING**

- A. Clean locker interiors and exterior surfaces.

**END OF SECTION**

**SECTION 10 5617**  
**WALL MOUNTED STANDARDS AND SHELVING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Steel shelf standards, brackets, and accessories.
- B. See drawings for locations and configurations.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry - Architectural: Wood blocking in walls for attachment of standards.
- B. Section 09 2116 - Gypsum Board Assemblies: Blocking in metal stud walls for attachment of standards.

**1.03 REFERENCE STANDARDS**

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021.
- C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021, with Errata (2022).
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store products under cover and elevated above grade.
- B. Store products in manufacturer's unopened packaging until ready for installation.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Steel Shelf Standards and Brackets:

**2.02 COMPONENTS**

- A. Steel Shelf Standards, Brackets, and Accessories:
  - 1. Super-Duty Shelf Standards and Brackets: Single-slotted channel standards for brackets adjustable in 1 inch increments along entire length of standard, drilled and countersunk for screws.
    - a. Load Capacity: Recommended by manufacturer for loading of 540 to 1,060 pounds per pair of standards.
    - b. Finish: Electroplated, chrome-look.
    - c. Brackets: 12 gauge, 0.1046 inch sheet steel, reinforced, locking into slots with molded nylon cam lock lever; size to suit shelves; same finish as standards.
    - d. Bracket Quantity: Provide one bracket for each 12 inches of standard length.

- B. Fasteners: Screws as recommended by manufacturer for intended application or as otherwise required by project conditions. Finish of exposed to view fasteners to match finish of standards and other components.

### **PART 3 EXECUTION**

#### **3.01 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Mount standards or brackets to solid backing capable of supporting intended loads.
- C. Install brackets, shelving, and accessories.

**END OF SECTION**

**SECTION 11 3100  
RESIDENTIAL APPLIANCES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Kitchen appliances.
- B. Laundry appliances.

**1.02 RELATED REQUIREMENTS**

- A. Section 22 1005 - Plumbing Piping: Plumbing connections for appliances.
- B. Section 26 0583 - Wiring Connections: Electrical connections for appliances.

**1.03 REFERENCE STANDARDS**

- A. UL (DIR) - Online Certifications Directory; Current Edition.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.
- C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).
- C. Gas Appliances: Bearing design certification seal of American Gas Association (AGA).

**1.06 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.
- C. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.
- D. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

**PART 2 PRODUCTS**

**2.01 KITCHEN APPLIANCES**

- A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.
- B. Refrigerator: Free-standing, side-by-side, and frost-free
  1. Capacity: Total minimum storage of 18 cubic ft; minimum 15 percent freezer capacity.
  2. Energy Usage: Minimum 20 percent more energy efficient than energy efficiency standards set by U.S. Department of Energy (DOE).
  3. Features: Include glass shelves, automatic icemaker, light in freezer compartment, and in-door water and ice dispenser.
  4. Exterior Finish: Stainless steel, color black.
- C. Microwave: Countertop.
  1. Capacity: 0.7 cubic ft.
  2. Power: 700 watts.
  3. Features: Include turntable, cooktop light, night light, 2-speed exhaust fan, built-in trim kit, and undercabinet mounting kit.
  4. Exterior Finish: Black.

## **2.02 LAUNDRY APPLIANCES**

- A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.
- B. Clothes Washer, Guest Laundry: BASIS OF DESIGN: Maytag MHN33PD.
  - 1. Finish: Painted Steel, color as indicated.
- C. Clothes Dryer, Guest Laundry: Natural gas, \_\_\_\_\_.
  - 1. Size: Compact.
  - 2. Controls: Solid state electronic, with electronic moisture-sensing dry control.
  - 3. Temperature Selections: One.
  - 4. Cycles: Include normal, permanent press, knit/delicate, and air only.
  - 5. Features: Include interior light, reversible door, stationary rack, sound insulation, and end of cycle signal.
  - 6. Finish: Painted steel, color as indicated.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify utility rough-ins are provided and correctly located.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.

### **3.03 ADJUSTING**

- A. Adjust equipment to provide efficient operation.

### **3.04 CLEANING**

- A. Remove packing materials from equipment and properly discard.
- B. Wash and clean equipment.

**END OF SECTION**

**SECTION 11 4000**  
**FOOD SERVICE EQUIPMENT**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. SECTION INCLUDES:

1. The food service equipment indicated on the FS drawings and Schedules. And as specified in this Section of the Project Specifications:
2. Work, in general, shall include furnishing, fabricating, delivering, erecting, setting-in-place and securing all of the food service equipment at locations shown on the Drawings.
3. Owner-Furnished Equipment: Where indicated on Equipment Schedule(s). Owner will furnish, and install equipment items.
4. Vendor-Furnished Equipment: Where indicated on Equipment Schedule(s). Vendor will furnish equipment items as close as possible to specified. If vendor requires utilities other than specified, Owner must inform General Contractor with copy to Architect prior to rough-ins.

B. RELATED SECTIONS:

1. Division 15 - Plumbing services and hook-up, including grease interceptors, shut-off valves, trim, traps and related fittings except as specified under individual equipment items in PART 3.
2. Division 15 - Mechanical services and hook-up including ventilator duct work upstream from ceiling and welded connections to ventilators and vent ducts.
3. Division 16 - Electrical services and hook-up, including wiring, line switches, safety cut-outs, control panels, contractors, fuse boxes or other related electrical controls and fittings except as specified under individual equipment items in PART 3.

**1.2 SUBMITTALS**

A. SHOP DRAWINGS:

1. Plumbing, Mechanical and Electrical Rough-In Drawings detailed and fully dimensioned to a minimum scale of 1/4" = 1'-0". Drawings shall show exact location and requirements of all floor and wall stubs and sleeves for plumbing, electrical, refrigeration lines, beverage lines and ventilation ducts.
2. Depression Plans for drain troughs and insulated floor areas detailed and fully dimensioned to a minimum scale of 1/4" = 1'-0".
3. Drawings of all equipment specified for fabrication detailed and fully dimensioned to a minimum scale of 3/4" = 1'-0". Show all dimensions, details of construction, installation and relation to adjoining work, reinforcing, anchorage and other work required for the complete food service equipment installation.
4. Manufacturer's Shop Drawings for hoods, ventilators, walk-in coolers and other specialized or customized equipment items not covered by standard Specification Sheets.
5. Submit one reproducible transparency and two direct prints of each shop drawing.

B. MANUFACTURER'S SPECIFICATION SHEETS:

1. Equipment Specification Sheets for all items of standard manufacture which show the manufacturer's name, size, descriptive data, capacities, utility requirements, approval labels, etc. Bind in brochure form in numerical sequence in its entirety and submit six copies for review and approval.

C. EQUIPMENT SERVICE MANUALS:

1. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under Contract which shall include equipment specification sheets, operating instructions, parts lists, service instructions, maintenance instructions, etc. Bind in brochure form in numerical sequence in its entirety and submit three copies for review and approval.

### **1.3 QUALITY ASSURANCE**

#### **A. CODES AND REGULATIONS:**

1. All work under this section shall be installed in strict conformance with all federal, state and local codes, laws, regulations and rules that govern food service facilities and operations.
2. All work under this section shall comply, as applicable, with:
  - a. National Sanitation Foundation and bear NSF label.
  - b. Underwriters Laboratories and bear UL label.
  - c. American Gas Association and bear AGA label.
  - d. American Society of Mechanical Engineers and bear ASME label.
  - e. National Fire Protection Association Standard NFPA-96

#### **B. FIELD MEASUREMENTS:**

1. Take field measurements prior to fabrication of custom equipment items. All equipment must conform to the finished building conditions. Where obstructions occur, the equipment must be scribed, fitted to and around same, resulting in a sanitary homogeneous fixture.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- A. **DELIVERY:** Deliver standard manufactured equipment items to the site ready for use in the manufacturer's original and unopened containers and packaging except those items incorporated in the custom fabrication work. Containers to bear labels stating manufacturer's name, model number and project item number.
- B. **STORAGE:** Store all products and materials under cover in a dry and clean location, off the ground.
- C. **HANDLING:** Protect finishes from damage during handling and construction of other work in the same space. Wrap and crate each item of equipment as necessary for protection from damage. Remove all products and materials which are damaged or otherwise not suitable for installation from the job site and replace with suitable products and materials.

### **1.5 PROJECT CONDITIONS**

- A. **EXISTING AND PROPOSED:** Verify all conditions at job site including utilities, door openings, passage sizes and elevator sizes to assure ingress of equipment.

### **1.6 WARRANTY**

- A. **STANDARD:** Compile Warranties executed and issued by respective manufacturers and suppliers. Bind in brochure form in numerical sequence in its entirety.
- B. **SPECIAL:** All compressors supplied for refrigerated units, either remote connected or as an integral part, shall be supplied with the manufacturer's four year extended warranty to provide a total of five years protection from the date of signed final acceptance. Include in same binders as described above for Standard Warranties.
- C. **SERVICE CONTRACT:** In addition to warranties stated above, provide Service Contract to include labor, materials and parts necessary to replace, repair or restore work of this section that fails or does not operate properly for a period of one year from date of signed final acceptance.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. **STAINLESS STEEL (S/S):** Shall be AISI Type 302 extra low carbon, non-magnetic, Austenitic 18% chrome, 8% nickel corrosion resistant alloy steel (ASTM A 240).
- B. **GALVANIZED IRON (G.I.):** Shall be a commercial quality steel - ASTM A 526 or ASTM A 527 for extensive forming. G90 zinc coated by the hot dip process.
- C. **GAUGES:** Gauges for sheet iron and steel shall be U.S. Standard Gauges and finished equipment gauge thickness shall not vary more than 5% plus or minus from thickness indicated below:
  - 1. 

GAUGE	THICKNESS
#10	0.1406 (3.50mm)
#12	0.1094 (2.75mm)
#14	0.0781 (2.00mm)
#16	0.0625 (1.50mm)
#18	0.0500 (1.25mm)
#20	0.0375 (1.00mm)
- D. **STAINLESS STEEL PIPE AND TUBING:** Shall be seamless or welded of gauge specified. Seamless tubing shall be thoroughly and correctly annealed, pickled and ground smooth. Welded tubing shall be thoroughly heat treated and properly quenched to eliminate precipitation, drawn true to size and polished to match stainless steel sheets.
- E. **STRUCTURAL STEEL:** Framing members consisting of angles, bars, channels, etc. shall be ductile in quality, free of hard spots, runs, checks, cracks and other defects. They shall be smooth galvanized by the hot dip process with all surplus removed and be free of runs, blisters, excess spelter and uncoated spots or patches.
- F. **PLASTIC LAMINATE:** Laminated plastic materials shall be Formica, Nevamar or as selected complying with NEMA LD 1 and NSF Standard 35 when applicable.

### **2.2 MANUFACTURED UNITS**

- A. **STANDARD CATALOG ITEMS:** Provide as listed and described in the SCHEDULE portion of PART 3 and Equipment Schedules shown on the Drawings.
- B. **ELECTRICAL REQUIREMENTS:**
  - 1. All portable equipment and items, which plug-in for normal use are to be furnished with an approved cord set to mate with receptacles furnished in the project.
  - 2. In the event that any item of equipment to be included in the work is not available in the electrical characteristics furnished on the project, provide a suitable transformer to make the item work properly on the available power supply.

### **2.3 SHEET METAL FABRICATION**

- A. **STRENGTH:**
  - 1. Include all necessary reinforcing, bracing, welding and the proper number and spacing of uprights and cross members.
  - 2. Wherever size permits, equipment shall be fabricated of a single sheet of metal.
  - 3. Equipment not braced in a rigid manner and which is subject to rattle or wobble will be unacceptable.
- B. **FINISH:**
  - 1. Stainless steel where exposed shall be polished to a #4 commercial finish. Where unexposed, finish may be #2B. The grain of polishing shall run in the same direction on all horizontal and vertical surfaces of each item.
  - 2. Exterior galvanized parts, exposed members of framework and wrought steel pipe where



specified to be painted shall be cleaned, properly primed with rust inhibiting primer, degreased and finished with two coats epoxy-based gray Hammertone paint.

C. WELDING:

1. All welding shall be done by the Heliarc method.
2. Where filler rods are used, they should be of the same grade composition as the materials to be joined and contain a flux to minimize carbide precipitation.
3. Welds shall be complete, strong and ductile, sound, non-porous, free of pits, cracks and other mechanical imperfections. Excess metal shall be ground off and polished smooth creating one homogeneous color and finish.
4. Unexposed welds shall be pacified and suitably coated to prevent corrosion.
5. In no case shall soldering be considered as a replacement for welding.
6. Where galvanizing has been burned off, touch up weld with high grade aluminum paint.

D. FIXTURES:

1. All custom fixtures shall be fabricated by one manufacturer.
2. In general, fixtures shall be shop fabricated of one-piece construction and shipped to the job site completely assembled ready to install. Equipment too large to transport or enter the building as one piece shall be constructed so that welded field joints can be made at the job site.
3. Exposed surfaces shall be free from bolt, screw and rivet heads. When bolts are required they shall be of concealed type and be of similar composition as the metal to which they are applied. Where bolts, screws or studs on the interior of fixtures are visible or may come in contact with hands or wiping cloths, they must be capped with an acorn nut with lock washer.
4. Suitable pipe slots shall be provided through all undershelves to accommodate necessary service lines. These slots shall be proper size and neatly made with turned up edges on all four sides to eliminate cutting or defacing equipment on the job site. Cabinet bases shall be provided with an inner panel duct at ends or rear of cabinet to allow for concealed pipe space.
5. Ends of all back splashes and hollow sections to be closed during fabrication of the fixture.

E. SOUND DEADENING:

1. Provide 1/2" wide rope sealant continuously between frame members and underside of table tops, drainboards, overshelves and undershelves. Tighten stud nuts for maximum compression of sealant.

F. PAINTING:

1. Provide the types of painting and coating materials which after drying or curing, are suitable for use in conjunction with food service, and which are durable, non-toxic, non-dusting, not-flaking, mildew resistant and comply with governing regulations for food service use
2. Finish fixtures, except stainless steel fixtures, in gray hammertone air dried enamel, glossy and without blemish.
3. Baked Enamel Finish. Oven bake for minimum of 1-1/2 hours at minimum temperature of 300 degrees F.

G. TRIM AND SEALING:

1. Trim is not an acceptable substitute for accuracy and neatness.
2. Equipment that butts walls shall be scribed and sealed to the walls with a silicone rubber sealant (Dow Corning 780, General Electric Series SE1200, or accepted substitute).
3. Where two or more pieces of equipment join, the seam shall be sealed with a silicone rubber sealant as above.

4. Hi-Temp silicone sealant shall be used at joints adjacent to or between pieces of heat producing equipment.

H. FABRICATION ELECTRICAL REQUIREMENTS:

1. All components and assemblies incorporated in the work shall bear the U.L. label.
2. Wiring shall be made in accordance with prevailing building codes and regulations.
3. Wiring and components shall be waterproof.
4. All fabricated equipment shall be completely wired internally where electrical services are required. All outlets, receptacles, switches, controls, electrical devices and equipment built into or forming an integral part of the fixture shall be furnished, installed and pre-wired to junction boxes. All wiring terminating in junction boxes shall be tagged showing item number, voltage, characteristics and load information.
5. Electrically heated equipment shall be internally wired to a thermostatic control and an "on/off" red neon pilot light both to be mounted in a terminal box on a removable control panel.
6. Rigid steel conduit shall be used for this work, zinc coated where unexposed and chrome plated where exposed.
7. Fluorescent light fixtures shall be complete with ballast and warm white lamps.
8. Receptacles for evaporator coils shall be twist lock type.

I. FABRICATION PLUMBING REQUIREMENTS:

1. All necessary faucets and drains shall be furnished with the food service equipment.
2. Water inlets shall be located above the positive water level to prevent siphoning of liquids into the water system. When submerged inlets are required, suitable check valves and vacuum breakers shall be furnished and installed on the fixture. Where exposed, the piping shall be chrome plated.
3. Cabinet type and closed fixtures shall have indirect wastes pre-piped within fixture to point of discharge above floor sinks. Piping to be chrome plated or stainless steel when exposed.

J. FABRICATION REFRIGERATION REQUIREMENTS:

1. Provide air-cooled condensing units mounted on friction slides in compressor housings with adequate air supply and exhaust for proper operation.
2. All refrigeration systems to be furnished with compressor, expansion valve, isolating valve, sight glass, strainer, dehydrator, relief valve, charging valve, lines and all necessary components to make a completely operable self-contained system.
3. Normal operating temperatures to be:
  - a. Refrigerators +35 degrees F.
  - b. Freezers -10 degrees F.
  - c. Cold Pans +10 degrees F.
4. All refrigerated pans and cabinets shall be fitted with breaker strips where adjoining top or cabinet face materials.

K. CHANNEL FRAME CONSTRUCTION:

1. All equipment of channel frame construction shall be supported by 1" X 5" X 1" X 14 Ga. galvanized channels secured to underside of tops with welded concealed studs, lock washers and acorn cap nuts (S/S when exposed).
2. Where channels intersect each other, they shall be fully welded.
3. Spacing of channels shall be on approximate 30" centers but so located to accommodate drawer enclosures, sinks, enclosed bases, etc.
4. All channels exposed to view shall be 14 Ga. S/S with ends closed.

L. LEGS, FEET & CROSSRAILS:

1. Equipment shall be supported on legs of 1-5/8" O.D. 16 Ga. seamless S/S fitted with S/S

bullet-type feet. Standard-Keil Series 1044, or equal. Feet shall have a minimum vertical adjustment of 1-1/2" without showing any evidence of threading. Height to the equipment shall be as specified with the feet exposed to a 2" vertical dimension so as to allow a maximum adjustment of 3/4" above and below that height.

2. Legs shall be attached by means of sanitary type fully enclosed conical gussets of 16 Ga. S/S. Standard-Keil 1018-0206-1283, or equal. Gussets shall be fully welded to channels or gusset plates.
3. All legs shall be braced with crossrails of 1-5/8" 16 Ga. S/S tubing coved and fully welded to legs at 10" above the floor unless specified otherwise. Where crossrails join cabinet bodies, provide Standard-Keil 1016-0206-1283 Leg Socket welded to body.
4. Legs shall not be spaced more than 5'-0" apart.
5. Cabinet bodies supported by legs to have minimum of 6" clearance between floor and bottom of cabinet

M. WORK TOPS:

1. All table tops, counter tops and drainboards shall be 14 Ga. S/S unless specified otherwise.
2. Tops shall have Flat Edge as specified under "Edge Types" on all exposed sides.
3. Where top overhangs body, a minimum gap of 3/4" shall be provided between bottom edge of top and cabinet body.
4. Where back splash or end splash is specified, an angled splash shall be formed by turning up top 90 degrees for 4", breaking back 2" on a 45 degree angle, and turning up 1". Close both ends.
5. Where flat splash or flat turn-up is specified, turn edge of top up 90 degrees with "Hug Edge" ground smooth.

N. UNDERSHELVES - OPEN CONSTRUCTION:

1. Undershelves in open base fixtures shall be constructed of 16 Ga. S/S notched at corners and fully welded to legs from the back side. Shelves shall be reinforced longitudinally with 1" X 5" X 1" channels.
2. Front edges of undershelves shall be formed with a Flat Edge as specified under "Edge Types". Ends & rear to be turned up 2" flat unless specified otherwise.
3. Height of bottom shelf shall be 10" above the floor unless otherwise specified.

O. EDGE TYPES:

1. Rolled Edge shall be formed by the top being rolled down 180 degrees on a 1-1/2" diameter.
2. Bullnose Edge shall be formed by the top being rolled down 120 degrees on a 1-3/4" diameter.
3. Flat Edge shall be formed by turning down the edge of the top 1-1/2" and then back 1/2" at 30 degree angle.
4. Inverted "V" Edge (Marine Edge) shall be formed by raising the edge of the top 1/2" high on a 45 degree angle, then turning down 1-1/2" and back 1/2" at 30 degree angle.
5. Raised Curb or Raised Rolled Edge shall be formed by the top being turned up 3" high and rolled in a 1-1/2" diameter to form a 190 degree closure with corners fully ground. All horizontal and vertical corners to be fully coved.

P. COMPARTMENT TYPE SINKS:

1. Sinks shall be fabricated of 14 Ga. S/S with all interior corners rounded to a 3/4" radius both horizontally and vertically. Front edge of sinks shall be Raised Rolled Edge. Back, bottom and front of all sinks shall be one continuous piece. Bottom of each compartment to be creased to a center waste outlet.
2. Drainboards shall be of 14 Ga. S/S, integral with the sinks, pitched 1/4" per foot to the sinks and with the same backsplash and rolled edge forming one continuous horizontal

- plane. Polish all backsplashes and tops to have metal grain running in one direction.
3. Partitions between compartments to be 1" wide X full depth double wall construction.
  4. Multiple sink compartments shall be provided with continuous and seamless front without applied trim strips, panels or full width facing piece.
  5. Back splashes and end splashes for sinks to be as specified above in Paragraph 2.3.M except turned up 8" in lieu of 4" before the 45 degree break.
  6. Freestanding sinks to have rear of backsplash fully enclosed with 16 Ga. S/S.
  7. Bottom of each sink to be fitted with a cast brass 2" rotary handle operated waste valve complete with S/S strainer, S/S handle assembly and connected overflow. Fisher Mfg. Co. Model 10707, or equal.
  8. One Compartment Sinks to be complete with (1) Fisher Mfg. Co. No.13269 Faucet. Two Compartment Sinks to be complete with (1) Fisher Mfg. Co. No. 13269 Faucet. Three Compartment Sinks to be complete with (2) Fisher Mfg. Co. No. 5412 Faucets.

Q. COUNTER SINKS:

1. Sinks shall be fabricated of 14 Ga. S/S with all interior corners rounded to a 3/4" radius both horizontally and vertically. Bottom of sink to be creased to a center waste outlet.
2. Sinks shall be set into table tops with top perimeter fully welded to edge of opening in table top to create one integral unit.
3. Bottom of each sink to be fitted with a cast brass 2" rotary handle operated waste valve complete with S/S strainer and S/S handle assembly. Fisher Mfg. Co. Model 10758, or equal.
4. Each sink to be complete with (1) Fisher 13269 Faucet (Splash mount) or (1) Fisher 3312 Faucet (Deck mount) as applicable.

R. ENCLOSED CABINET TYPE BASE:

1. Cabinet type bodies shall be formed of 18 Ga. S/S reinforced with 14 Ga. formed hat sections to create a rigid structure.
2. Ends of cabinet bodies to close to wall.
3. Base shall be welded construction with front rails, aprons, mullions and other components welded and polished to appear as one-piece construction.
4. Vertical mullions shall be 1-1/2" wide X 3/4" deep with the inside completely closed with a S/S channel that has top & bottom closed.
5. Interior shelves shall be 16 Ga. S/S all welded, suitably reinforced and formed with 1-1/2" Flat Edge on front. Rear and ends of shelves to be turned-up 2" and feathered slightly to insure tight fit to cabinet ends and/or partitions and be welded in place. Bottom shelves shall have front edge flush to and integral with front face of vertical mullions and to have rear and ends turned up as specified above.
6. Legs and feet shall be as specified in Paragraph 2.3.L above

S. HINGED DOORS

1. Hinged Doors to be double pan construction with 16 Ga. S/S exterior pan, 18 Ga. magnetic type 430 S/S interior pan and full size core of 1" thick urethane.
2. Doors to be flush mounted.
3. Hinges to be S/S lift-off slip-joint type with body side flush mounted in mullion and door side flush mounted in door edge. Standard-Keil 2874 Series, or equal.
4. Pulls to be S/S recessed-type tack welded in place. Standard-Keil 1260-1014-1283, or equal.
5. Magnetic catches to be heavy duty floating magnet type. Standard-Keil Number 2932-1010-3000, or equal.
6. Doors at compressor housings to be single pan 16 Ga. S/S construction with 3" X 1" 18 Ga. magnetic type 430 S/S channel full perimeter inside frame. Weld all corners. Provide small diamond mesh expanded metal inset. Milcor "Small Mesh", or equal (11,000 meshes per square yard). Spray mesh with aluminum paint.

T. DRAWERS

1. Drawer faces to be double pan construction with 16 Ga. S/S exterior pan, 18 Ga. S/S interior pan and full size core of 1" thick urethane.
2. Provide full perimeter rubber bumper with mitered corners on inside pan of drawer face. Standard-Keil 2740-1212-3000, or equal.
3. Drawers to be provided with heavy duty ball-bearing extension roller slides spot welded to pan frame. Standard-Keil 1415-1022-1000, or equal. Drawers to be make self-closing by pitching slides 3/4" back to front.
4. Pan Frame shall be 16 Ga. S/S. Sides and rear of 3/4" X 2" angles and front of 1" X 4" angle. Weld front to inner pan of drawer face.
5. Drawer to be enclosed in 16 Ga. S/S housing secured to underside of table with studs, lock washers and cap nuts.
6. Pulls shall be S/S recessed- type tack welded in place. Standard-Keil 1260-1410-1283, or equal.
7. Locks when specified shall be Standard-Keil 1230-3216-3000, or equal.
8. Provide each drawer complete with 20" X 20" X 5" S/S coved corner drawer pan. Standard-Keil 1481-2020-3282, or equal.
- 9.

U. CASTERS:

1. Medium duty ball bearing casters with capacity of 300 pounds each.
2. Tires to be 5" diameter X 1-1/8" wide of non-marking red polyurethane.
3. Each mobile unit shall be provided with (2) brake casters (Standard-Keil 1123-3445 3000) and (2) non-brake casters (Standard-Keil 1123-3446-3000), or equal. Mount brake casters diagonally.

V. OVERSHELVES:

1. Wall Hung Shelves shall be 16 Ga. S/S with 1-1/2" Rolled Edge on front, 1-1/2" Flat Edge on ends and 2" high integral back risers.
2. Wall Hung Shelves to be supported on 14 Ga. S/S cantilevered triangular brackets of all welded construction. Top, bottom & back flanges of brackets shall be 1-1/2" wide and secured to wall with S/S bolts with toggles or expansion shields. Secure brackets to studs welded on bottom of shelves with lock washers and S/S cap nuts. Height of wall bracket shall be 6/10 of shelf width. Brackets shall have maximum longitudinal spacing of 5'-0".
3. Install shelves 60" A.F.F. to top surface of shelf unless specified otherwise.
4. Fixture Overshelves shall be 16 Ga. S/S with 1-1/2" Rolled Edge on front, 1-1/2" Flat Edge on ends and 2" high integral back risers.
5. Fixture Overshelves to be supported on 1-1/4" O.D. 16 Ga. S/S tube supports thru top of splash and welded to top framing extended back thickness of splash. Tube supports to be fitted with 14 Ga. S/S brackets welded to supports and sized as indicated above for wall shelves. Weld tube supports full perimeter at penetrations of back splash, grind and polish.
6. Install shelves 60" A.F.F. to top surface of shelf unless specified otherwise.

**2.4 PRODUCT REFRIGERATION**

A. SYSTEMS:

1. Provide all equipment refrigeration work indicated on the drawings, equipment schedules and specifications including but not limited to: condensing units, evaporator units, controls, piping and all accessories and components as required to provide complete and operable systems in accordance with approved refrigeration practice.
2. Manufacturer's directions shall be followed in all cases where the manufacturer furnishes directions covering points not shown on the drawings and specifications.

B. PIPING:

1. Routing must be coordinated with other trades to avoid conflict of space use.
2. All horizontal and vertical runs of tubing shall be securely supported and/or fastened to prevent sagging. No sharp bends or kinks will be permitted. Piping and manifolds to be kept high as practicable to avoid trapping suction lines.
3. After lines have been run, all sleeves including sleeves through refrigerator bodies shall be, caulked and made water-tight using Permagum, Pecora or equivalent material.
4. Connections in piping shall be accomplished using sweat fittings except at easily accessible valves and controls where flared fittings may be used.
5. Cap all piping until final connections are made.
6. Refrigerant pipe shall be type "L" all hard drawn seamless copper tubing with silver soldered joints.
7. Piping within walk-in compartments shall be finished with Chromotone paint.
8. All lines outside of refrigerated compartments shall be insulated the entire length from evaporator to the condensing unit with 3/8" thick Armstrong "Armaflex", or accepted substitute. Group insulation of lines is not permitted.
9. Provide drain line heaters wired for evaporator line voltage in all freezer compartments.

C. **SYSTEM COMPONENTS:**

1. Each system shall consist of refrigerant, Type "L" piping, liquid & suction line stop valves, evaporator, thermostatic expansion valve, heat exchanger, liquid line solenoid valve, filter-drier, liquid indicator, vibration eliminator and condensing unit.
2. Temperature of refrigerated compartments shall be controlled by means of a thermostat wired to actuate a solenoid valve in the liquid line.
3. Provide all hangers for evaporator coils as required.
4. Refrigerant shut-off valves in the refrigerant piping shall be Henry, or accepted substitute, for line sizes 7/8" O.D. and larger and packless diaphragm type for smaller sizes.
5. Expansion valves shall be Sporrán, or accepted substitute, and placed in the liquid line at the point where line enters the evaporator.
6. Filter-Drier shall be Sporrán, or accepted substitute.
7. Sight-glass shall be Sporrán, or accepted substitute, and placed in the liquid line.
8. Solenoid valves shall be Sporrán type with manual lift stem, or accepted substitute, and placed in the liquid line with room thermostat.

D. **TESTING:**

1. Lines shall be blown out with dry nitrogen prior to making final connections.
2. Accomplish pressure test to 150 pounds (or higher if required by code).
3. Evacuate system with a vacuum pump for a period of 24 hours. Break vacuum with refrigerant to 0 PSIG, re-establish vacuum and charge with refrigerant for operation. Run operational check for 3 days.

**2.5 PRE-FABRICATED WALK-IN COOLERS & FREEZERS**

A. **PANELS:**

1. Pre-fabricated modularized sectional-constructed panels with a 4" thick core of rigid urethane "foamed in place" insulation. Urethane to bind tenaciously to interior and exterior metal pans to form a rigid structurally sound wall without the use of any wood support members. Slab urethane, polystyrene, high-density rails or wood shall not be acceptable in any panel including doors, walls and ceilings. "U" Factor shall not exceed .035. Finish to be 20-gauge stainless steel exposed exterior. Interior walls shall be 0.35 stucco embossed aluminum, interior ceiling shall be 0.35 aluminum with white acrylic finish, and non-exposed exterior shall be 26 ga. Galvanized steel. Overall height to be 8'-6-1/4" high.
2. Panel joints shall be tongue and groove with flexible double bubble vinyl gasket foamed attachment to the flange of the metal skins along inside and outside at the abutting interface of each panel joint.

3. Panels shall be joined with cam action hooked locking arms engaging steel rods in adjacent panel with a minimum of three locks on each vertical joint.
  4. Ceiling panels to be 5" thick core of rigid urethane "foamed in place" insulation with a U factor of .028.
- B. INTERIOR PARTITIONS:
1. When required, shall be of same construction as the perimeter panels.
- C. FLOORS:
1. Pre-fabricated Floor: When required, to be constructed of insulated modularized panels made to withstand loads up to 700 pounds per square foot and with .100 aluminum foamed-in-place treadplate wearing surface. .100 aluminum treadplate reinforced ramps at each door.
  2. Built-in insulated floors: Provide floor screeds with gaskets when the building floor at walk-in locations has been properly insulated and fitted with redwood breakers. Floor Screeds to be furnished for all wall panels and be secured and sealed to the building floor.  
Provide for depressed subfloor membrane and insulation assembly as per detail drawing including the following:  
Apply to clean, smooth an level subfloor asphalt emulsion (ASTM D1187 claytype). Cover with Alumiseal Zero Perm vapor barrier (0.00 perm as determined by ASTM E96-80) joints lapped 6 inches minimum, and flashed up sides of recess.  
  
Install 2 layers of 2" thick rigid urethane boardform same density and conductivity as panel insulation, joints shall be staggered.  
  
Apply 15 pound protective felt strip over insulation, flashed up the sides of the wall panels the height of the cove base, with joints lapped 6 inches minimum.
- D. COVERED BASE:
1. When Pre-fabricated floors are specified, provide 18 gauge S/S Covered Base at all exterior walls.
  2. When Walk-ins are erected on built-in insulated building floors, provide 18 gauge S/S Covered Base at all interior walls and exposed exterior walls when quarry tile covered base is not provided as part of the building floor.
- E. LISTINGS: Walk-Ins shall be listed with U.L. and NSF and bear their labels. Additional each compartment shall bear a label indicating "Class 1-Insulated panel as certified by an independent testing laboratory" to have surface burn spread 25 or less determined by ASTM E-84.
- F. DOORS:
1. Doors are to be in-fitting flush-type with:
    - a. Clear Opening of 36" X 78".
    - b. 15" X 20" Tri-Pane glass vision panel with heater wire full perimeter.
    - c. Replaceable dual-blade adjustable rubber wiper gasket.
    - d. Kason model 58 (padlock hole) keyed latch with inside release.
    - e. Kason No. 1256 cam-lift chrome plated hinges. (three per door)
    - f. Bellows type gasket with vulcanized corners and continuous magnetic core.
    - g. Heater wires in perimeter of door. Pre-wire to electric splice box. Non exposed electrical in both cooler and freezer doors.
    - h. 36" high kickplate of 1/8" diamond treadplate on interior and exterior door and jamb.

- i. Adjustable hydraulic arm door closer, with hold open feature.\
- j. Front, back and edges of door(s) shall be clad with 20 gauge #304 stainless steel. Sheet metal joints of door shall be heliarc welded, ground smooth and polished.
- k. All hardware shall be mounted with reinforced 1/8" steel tapping plates.
- l. Interior door bumper bar shall be 1/4" x 2" aluminum channel, 3'-0" above finished floor.

**G. DOOR FRAME:**

- 1. Door frame to match finish and construction of wall panels and be fitted with:
  - a) Kason No. 1830 two-way heated pressure relief ventilator port (In freezers only).
  - b) Kason four foot fluorescent fixture No. 1810F00048.
  - c) Factory install and wire interior and exterior companion 3-way and or 4-way AC press-switches, where indicated, mounted in "FS" boxes adjacent to latch side of door opening. Switch covers shall be neoprene, weatherproof press-switch with embedded red plastic pilot light. Interior red light shall be constant burning and exterior indicating lights are on. Rigid UL listed conduit and wiring shall be run within insulated wall panel. Conduit shall be terminated with "EI" seal off at exterior of roof panel. Only conduit and wiring within wall panel. Including boxes, light fixture, switches and cover plates, shall be furnished as part of this section .
  - d) Exterior flush dial thermometer 2 1/2".
  - e) Extruded Aluminum threshold and heater wire channel with 12 gauge stainless steel threshold.
  - f) All hardware shall be 3/16" stainless steel machine screws with nyloc, drilled and tapped.
  - g) Door casing raised 1/4" an 4 inches wide at sides and head, clad with 18 gauge stainless steel.

- H. CLOSURE PANELS: When open spaces occur between top of walk-in and building finished ceiling, and/or between walk-in walls and building walls, close openings with 20 gauge stainless steel closure panels or trim to match exterior walls of walk-ins.

**2.6 MILLWORK FABRICATION**

**A. STANDARDS**

- 1. Construction and installation of all millwork shall be as indicated on the drawings and shall conform to the requirements of all Architectural Woodwork Institute Standards of "custom grade" work.

**B. MATERIALS**

- 1. Millwork and materials shall conform in all respects to codes for fire retardant treatments.
- 2. Unexposed wood shall be Grade B Red Gum, Yellow Poplar, Birch or other suitable hardwood standard with the mill shop. Plywood shall be Douglas Fir or Birch of the thickness indicated on the drawings or as required, good one or both sides as conditions require. Exposed faces shall be surfaced with a medium density phenolic overlay. Hardwood, plywood, particleboard core, good one or both sides as required. Shall have face veneers of the species and match indicated on the drawings. Moldings, trim, solid hardwood exposed to view, etc. shall be of the shapes and sizes indicated on the drawings. Birch shall be plain sawn and oak shall be plain sawn "Red Oak" unless otherwise indicated. Plastic laminate for cabinetwork shall be Formica, Nevamar, or as approved. All materials shall be laminated to close-grained plywood such as birch or douglas fir of selected smooth sanded stock to insure a ripple free surface. Top sheet shall be placed on and over finished edge. Millwork that abuts exterior walls shall be back primed.

**2.7 EXISTING EQUIPMENT**



- A. UTILITY CONNECTIONS:
  1. Work of this Section does not include disconnecting or reconnecting of plumbing, electrical or mechanical services from and/or to the existing food service equipment.
  2. Disconnecting and reconnecting Work is to be performed by the respective trades per Paragraph 1.1B or the Food Service Equipment Specifications.
- B. REMOVAL & STORAGE:
  1. Remove and store at a location as directed, for the duration of the Construction Phase, all equipment scheduled for re-use.
- C. EQUIPMENT CONDITION:
  1. Existing Equipment scheduled for re-use has been inspected and found to be in good working order. If this Contractor finds any concealed damage or other conditions detrimental to re-use during the process of removing and reconditioning, he shall notify the Owner and/or General Contractor of his findings.
- D. RECONDITIONING:
  1. Steam clean all grease coated or food encrusted items of equipment.
  2. Perform minor surface repairs, reweld, grind & polish broken welds, replace broken or missing small parts such as knobs and repaint all damaged painted surfaces with paint matching original.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. INSPECTION:
  1. Study the contract drawings and specifications with regard to the work as shown and required under this Section so as to insure its completeness.
  2. Examine surfaces and conditions to which this work is to be attached, or applied, or occupy. Starting on the work shall imply acceptance of the surfaces and conditions to perform the work as specified.
  3. Verify by measurements taken at the job site, those dimensions affecting the work. Bring field dimensions which are at variance with those on the approved shop drawings to the attention of the Architect. Obtain decision regarding corrective measures before the start of fabrication or installation.
  4. Coordinate equipment provided and all utility requirements with respective drawings and specifications to assure proper rough-in, utility services and conformance to applicable code requirements.
  5. Cooperate in the coordination and scheduling of the work of this Section with the work of other sections so as not to delay job progress.

#### **3.2 INSTALLATION**

- A. GENERAL:
  1. Install all equipment in strict accordance with manufacturer's directions and recommendations by skilled mechanics of trades generally associated with individual items. Secure and seal all items in place as shown on the drawings.
  2. Provide competent field representative to be present to advise the respective trades (Such as utility rough-in work and hook-up), and verify size and location of all concealed utility work before it is covered.

#### **3.3 PROTECTION AND CLEANING**

- A. PROTECTION:
  1. Protect the installed work using adequate and suitable means, during and after installation and until accepted by Owner.
  2. Perform all final adjustments just prior to final inspection.
- B. REPAIR:

1. Surfaces which become damaged, marred, scratched, abraded or are not sound shall be repaired or removed and replaced, as determined by the Owner.
- C. **CLEANING:**
1. Clean surfaces of grime, dust and general construction dirt and polish all equipment prior to final inspection and acceptance.

### **3.4 TESTING AND REGULATING**

- A. **GENERAL:**
1. Test, regulate and prove to the Owner or his representative that all equipment is operating properly.
- B. **START-UP:**
1. During testing and start-up, the Manufacturer's Representative for each item of standard manufacture shall be present and shall instruct the Owner's personnel in proper operation, maintenance and safety procedures.

### **3.5 SCHEDULE OF EQUIPMENT**

- A. **ITEM SPECIFICATIONS:**
1. Refer to Equipment Schedule on Drawings.
  2. Item Equipment Numbers correspond to equipment item numbers on the drawing plans, elevations and details. Item Specifications describe equipment desired and required for this project.
  3. Requests submitted in accordance with requirements for Substitutions or Prior Approvals will be governed equal by comparison to standard specified manufacturer's published specifications in regard to sizes, capacities, function, finish and project compatibility of utility sizes and characteristics.

#### **ITEM 1 - AIR CURTAIN (1 REQ'D)**

Mars Air Systems Model LPV242-1UA-OB  
LoPro Series 2 Air Curtain, for 42" wide door, unheated, galvanized steel cabinet, obsidian black powder coat finish, (1) 1/6 HP motor, cETLus

#### **Accessories:**

- 1 ea 5 year warranty
- 1 ea 1 year warranty for all parts (except filters)
- 1 ea Mechanical switches
- 1 ea Door Limit Switch, indoor, plunger type, remote mounted
- 1 ea Brackets

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

#### **ITEM 2 - WIRE SHELVING UNIT (1 REQ'D)**

Metro Model CHROME  
Super Erecta® Starter Shelving Unit, (4) posts, chrome plated finish, KD, NSF. See FS Plan for size & configuration.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

#### **ITEM 3 - WALL SHELF (1 REQ'D)**

John Boos Model PB-MSS824

Utility Shelf, wall-mounted, 24"W x 8"D, Stallion Safety Edge front, 1-1/2" riser on sides & rear, includes hooks & (2) mop/broom holder with locking cam, 16/300 stainless steel, KD

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 4 - SERVICE FAUCET (1 REQ'D)**

Fisher Model 8253

Service Sink Faucet, wall mount mixing faucet with 8" adjustable centers, EZ Install adapters, 6" spout with garden hose outlet, lever handles, 1/2" inlets

Accessories:

2 ea Model 2400-2103 Elbow, 1/2" F x 1/2" F, 90°, brass

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 5 - MOP SINK (1 REQ'D)**

John Boos Model PBMS2820-12

Mop Sink, floor mounted, 32-5/8"W x 23-3/8"D x 16"H overall size, 28"W x 20" front-to-back x 12" deep compartment, 3-1/2" diameter drain, marine edge on front & sides, tile edge on rear, 16/300 stainless steel construction, NSF

Accessories:

1 ea Model MSWC2016-27 Mop Sink Wainscoting, rear, 24-7/8"L x 27"H, 16 ga. stainless steel

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 6 - SPARE NUMBER**

**ITEM 7 - CAN RACK (1 REQ'D)**

New Age Model 1250

Can Storage Rack, stationary design with adjustable feet, sloped glides for automatic can retrieval, aluminum construction, holds (162) #10 cans or (216) #5 cans, NSF, Made in USA, (standard factory lead time)

Accessories:

1 ea Lifetime warranty against rust & corrosion, 5 year workmanship and material defects warranty

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 8 - WIRE SHELVING UNIT (8 REQ'D)**

Metro Model CHROME

Super Erecta® Starter Shelving Unit, (4) posts, chrome plated finish, KD, NSF. Various sizes, see FS Plan for size & configuration.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 9 - SODA SYSTEM (1 REQ'D)**

SODA SYSTEM, N.I.K.E.C. SUPPLIED & INSTALLED BY VENDOR

**ITEM 10 - SPARE NUMBER**

**ITEM 11 - SPARE NUMBER**

**ITEM 12 - SPARE NUMBER**

**ITEM 13 - WALK-IN COOLER/FREEZER (1 REQ'D)**

American Panel Corporation Custom Prefabricated Unit

Two compartment Walk-In Cooler and Freezer to have Foamed-in-Place 4" Urethane panels. Provide with accessories and finished noted on manufacturer's shop drawings within the Foodservice plan set. Freezer compartment to include 4" foamed integrated floor panels with integral ramp. See walk-in shop drawings for specification and details on sheet

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 14 - COOLER EVAP COIL (1 REQ'D)**

American Panel Corporation Model BEL015BS6AM

Low profile blower coil to maintain 35 degree operation with EC motors. See refrigeration shop drawing for specification and detail.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 15 - FREEZER EVAP COIL (1 REQ'D)**

American Panel Corporation Model BEL0065BS6EE

Low profile blower coil to maintain 0 to -5 degree operation with EC motors. See refrigeration shop drawing for specification and detail.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 16 - COOLER CONDENSING UNIT (1 REQ'D)**

American Panel Corporation Model FFAP-A20Z-075

Roof mounted air cooled unit with weather proof housing. Provide with line sets, timers, valves and components for a complete and operable system. See walk-in submittal drawing for specification and detail.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 17 - FREEZER CONDENSING UNIT (1 REQ'D)**

American Panel Corporation Model FFAL-A126Z-TFC-075

Roof mounted air cooled unit with weather proof housing. Provide with line sets, timers, valves and components for a complete and operable system. See walk-in submittal drawing for specification and detail.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 18 - SPARE NUMBER**

**ITEM 19 - WIRE SHELVING UNIT (19 REQ'D)**

Metro Model EPOXY

Super Erecta® Starter Shelving Unit, (4) posts, Metroseal Green finish, KD, NSF. Various sizes, see FS Plan for size & configuration.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 20 - BUN / SHEET PAN RACK (5 REQ'D)**

Advance Tabco Model PR18-3W

Pan Rack, mobile, full height, end loading, 20-1/4"W x 26"D x 63-1/4"H, (18) 18" x 26" sheet pan capacity, slides on 3" centers, open sides, all-welded aluminum construction, 5" swivel casters, NSF

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 21 - SPARE NUMBER**

**ITEM 22 - SPARE NUMBER**

**ITEM 23 - WIRE SHELVING UNIT (2 REQ'D)**

Metro Model CHROME

Super Erecta® Starter Shelving Unit, (4) posts, chrome plated finish, KD, NSF. See FS Plan for size & configuration.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 24 - HAND SINK (4 REQ'D)**

Advance Tabco Model 7-PS-58

Hand Sink, wall mounted with skirt, 9" wide x 9" front-to-back x 5" deep bowl, Deep Drawn™ sink bowl, 20 gauge 304 stainless steel, welded 7-3/4" H side splashes, heavy duty splash mounted faucet, knee valve, 1-1/2" flat-top strainer, keyhole wall mount bracket, NSF, cCSAus

Accessories:

- 4 ea Model K-08 Low-flow aerator 0.5gpm, fits 55/64-27 male or 15/16-27 female thread on spout, conforms to California AB 1953
- 4 ea Model K-425 Thermostatic Mixing Valve, for knee pedal, foot pedal and electronic hand sinks and valves
- 4 ea Model 7-PS-10 P-trap, heavy duty, 1-1/2", 17 gauge

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

#### **ITEM 25 - SHELVING UNITS (2 REQ'D)**

Advance Tabco Model WS-12-78-16

Shelf, wall-mounted, 78"W x 12"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF (units 84" & longer have (3) support brackets)

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

#### **ITEM 26 - INGREDIENT BIN (4 REQ'D)**

Rubbermaid Commercial Products Model FG360088WHT

ProSave® Ingredient Bin, 2-3/4 cu. ft., 13-1/8"W x 29-1/4"D x 28"H, mobile, slant front with sliding lid, 32 oz scoop, seamless construction, 3" extra wide casters front fixed & rear swivel, white base/clear lid, USDA, FDA, NSF, Made in USA

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

#### **ITEM 27 - WORK TABLE, STAINLESS STEEL TOP (1 REQ'D)**

Advance Tabco Model TKMS-30X78

Work Table, 78"W x 30"D, 16 gauge 304 stainless steel top with 5"H backsplash, stainless steel legs with side & rear crossrails, adjustable stainless steel bullet feet, NSF

Accessories:

- 1 ea Model TA-31 Side Splash, 5" high

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

#### **ITEM 28 - EQUIPMENT STAND, FOR MIXER / SLICER (2 REQ'D)**

Advance Tabco Model MT-SS-300

Equipment Stand, 30"W x 30"D x 24"H, 14/304 stainless steel top, 18 gauge stainless steel adjustable undershelf & legs, adjustable stainless steel bullet feet, NSF

Accessories:

2 st Model TA-25ES Casters, 5" diameter, set of 4 (2 with brakes) with stainless steel for 24" tall tables & mixer stands (capacity 200 lbs per caster)

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 29 - PLANETARY MIXER (1 REQ'D)**

Hobart Model HL200-1STD

; Bench type mixer; with bowl, beater, whip & spiral dough arm, US/EXP configuration - Legacy Planetary Mixer, Bench, 20 quart, (3) fixed speeds plus stir speed, gear-driven transmission, 15-minute SmartTimer™, #12 taper hub, manual bowl lift, stainless steel bowl, aluminum "B" beater, stainless steel "D" wire whip, aluminum "ED" spiral dough arm, stainless steel bowl guard, 1/2 hp, cord with plug

Accessories:

1 ea 1-Year parts, labor & travel time during normal working hours within the USA

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 30 - FOOD SLICER, ELECTRIC (1 REQ'D)**

Hobart Model HS7N-1

Heavy Duty Meat Slicer, automatic, 13" CleanCut™ knife, burnished finish, (3) stroke lengths & (4) stroke speeds, removable meat grip assembly, removable ring guard cover, single action top mounted sharpener with Borazon™ stones, cleaning kickstand, 120v/60hz/1-ph, NSF cETLus

Accessories:

1 ea 1-Year parts, labor & travel time during normal working hours within the USA

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 31 - PREP TABLE W/ SINK (1 REQ'D)**

Custom Fabricated Stainless Steel

304 14 ga S/S top with 6" back and left end splash and (1) 18"x24"x14" fully welded sink bowl. Provide with splash mount faucet and leverwaste with support bracket. Provide with 1/4" S/S cutting board supports welded to sink bowl for 1" thick white poly cutting board inserts to sit flush when in use. Provide with S/S cutting board storage brackets, S/S legs and undershelves, with drawer per plans and elevations.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans

**ITEM 32 - SHELVING, WALL MOUNTED (2 REQ'D)**

Advance Tabco Model WS-12-72-16

Shelf, wall-mounted, 72"W x 12"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

### **ITEM 33 - FOOD PROCESSOR, BENCHTOP / COUNTERTOP (1 REQ'D)**

Robot Coupe Model R2N

Commercial Food Processor, 3 liter gray polycarbonate bowl with handle, vegetable prep attachment with external ejection, kidney-shaped opening, includes: (1) "S" blade (27055), (1) 2mm grating disc (27577), (1) 4mm slicing disc (27566), continuous feed, bowl attachment designed for vertical cutting & mixing, on/off & pulse switch, single speed, 1725 RPM, 1 HP, , cETLus, ETL-Sanitation

Accessories:

1 ea 1 year parts & labor warranty

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

### **ITEM 34 - IMMERSION HAND MIXER (1 REQ'D)**

Robot Coupe Model MP450

Commercial Power Mixer, hand held, 18" stainless steel shaft & 10" whisk attachment, removable stainless steel foot & blade, includes: (1) stainless steel wall support & (1) blade disassembly tool, 100 liter processing capacity, variable speed 3,000 - 10,000 RPM (mixer), 500 - 1,800 RPM (whisk), 1.1 HP, , "Easy plug" system with detachable power cord, cETLus, ETL-Sanitation

Accessories:

1 ea 1 year replacement warranty

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

### **ITEM 35 - SPARE NUMBER**

### **ITEM 36 - EXHAUST HOOD (1 REQ'D)**

Captive-Aire Model ND-2-PSP-F

EXHAUST HOOD

S/S construction, S/S type grease filters, front eye brow make-up air plenum. Hoods to be pre-piped for fire suppression system. See manufacturer Data sheet for additional information.

1. Stainless steel construction where exposed
2. Hood to be UL listed
3. Stainless steel Captrate Solo type baffle filters.
4. Provide stainless steel closure panels from top of hood to building ceiling
5. Incandescent light fixtures w/ wire lamp guards located as shown on plans
6. Mount unit to overhead building structure w/ bottom of hood at 78" above finished floor

Provide to site in crated for installation by G.C. Coordinate delivery schedule with G.C. Item should be



provided with all accessories listed and shown on hood submittal pans in FS plan set and meet utility requirements listed on rough-in plans.

**ITEM 37 - FIRE SUPPRESSION SYSTEM (1 REQ'D)**

Captive Aire Model R-102

Wet chemical, pre-piped system with mechanical gas shut off valve, chrome plated drops where exposed, nozzles, tanks and fuses for a complete and operable system. KEC to provide with all tests & permits with installation.

1. Wet chemical pre-piped system for type I exhaust hoods.
2. System to provide ventilator, duct and surface protection in compliance w/ NFPA and all applicable codes
3. System to be complete with shut-off valves, chrome plated nozzles and exposed piping, cables, conduit, cylinders, pull stations, micro-switch w/ dual contacts and parts of every description for a complete operable system.
4. System to be installed by authorized personnel in accordance w/ UL listing
5. Provide, install and label remote pull station where indicated on plans.
6. Provide complete system including all required permits and testing.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 38 - RANGE, 36", 6 OPEN BURNERS (1 REQ'D)**

Imperial Model IR-6-C

Pro Series Restaurant Range, gas, 36", (6) open burners, convection oven, 1/2 HP blower motor, porcelain interior, (3) chrome racks, removable crumb tray, stainless steel front, sides, backguard, landing ledge & kick plate, 6" legs, adjustable feet, 222,000 BTU, NSF, CE, CSA Flame, CSA Star

Accessories:

- 1 ea Limited one year parts and labor warranty
- 1 ea Stainless steel backguard with shelf standard
- 1 ea Swivel casters (set of 4) two with brakes, per set
- 1 ea Quick disconnect & flex hose with restraining device, 3/4" N.P.T. x 48"

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 39 - TILTING SKILLET BRAISING PAN, ELECTRIC (1 REQ'D)**

RATIONAL Model IVARIOPRO L

iVario Pro L Multifunctional Cooking Center, (1) 26 gallon pan, integrated iVarioBoost energy management system, 85° to 480°F temperature range, iZoneControl with up to (4) individually controlled heating zones, iCookingSuite intelligent cooking system, 6-point sensor core temperature probe, AutoLift (baskets and arm required for use), portioned water dispenser, retractable hand shower, Ethernet interface, WiFi enabled, includes stand with plastic feet, 208/CE, ETL, NSF, IPX5

Accessories:

- 1 ea 2 years parts and labor warranty
- 1 ea Model CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge
- 1 kt Model 60.71.267 Caster Kit, (4) casters, for size L and XL

1 ea Model 60.74.865 Storage Cabinet for Base, open front, (2) compartments, for storing GN accessories, for iVario L models

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 40 - S/S WALL FLASHING (1 It REQ'D)**

Custom Fabricated Stainless Steel

304 18 ga S/S construction from cove base to ceiling with "T" trim strip moldings.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 41 - COMBI OVEN (1 REQ'D)**

RATIONAL Model ICP 6-FULL ON 6-FULL NG 208/240V 1 PH

Two (2) (CC1GRRRA.0000238) iCombi Pro® 6-Full Size Combi Ovens, double stack, natural gas, (12) 18" x 26" sheet pan or (24) 12" x 20" steam pan or (12) 2/1 GN pan capacity, (6) stainless steel grids included, intelligent cooking system with (4) assistants; iDensityControl, iCookingSuite, iProductionManager, & iCareSystem, (6) operating modes, (5) cooking methods, (3) manual operating modes, 85° to 572°F temperature range, quick clean, care control, eco mode, 6-point core temperature probe, retractable hand shower, Ethernet interface, Wi-Fi enabled, 106,500 BTU each, 208/6 ft. cord, each, CE, IPX5, cCSAus, NSF, ENERGY STAR®

Accessories:

- 1 kt Model 60.75.752 Combi-Duo Universal Stacking Kit, for iCombi 6-half size or 6-full size (electric or gas) on iCombi 6-full size
- 1 ea Model 60.31.203 Stand I Stationary Oven Stand for Combi-Duo, 7-3/4"H, open sides, for iCombi 6-full size on 6-full size
- 1 ea Model 60.31.204 Stand I for Combi-Duo, mobile, 7-3/4"H, all sides open, stainless steel construction, height adjustable casters, for iCombi 6-full size on 6-full size
- 1 ea 2 years parts and labor, 5 years steam generator warranty
- 1 ea Model CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge
- 1 ea Model 56.00.562 Care Tabs, bucket of 150 packets for all iCombi Pro/Classic models and SelfCooking Center® units from 10/2008, with CareControl - Serial SG, SH or SI series (minimum order quantity: 2pcs, unless ordered with a unit)

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 42 - WATER FILTRATION SYSTEM, CARTRIDGE KIT (1 REQ'D)**

RATIONAL Model 1900.1150US

Water Filtration Double Cartridge System, for full-size Combi-Duos or if used for more than (2) units, includes: (1) double head with pressure gauge, (2) R95-CL filter & (1) filter installation kit (for each additional unit add (1) additional head & additional cartridge. Maximum (4) cartridges)

Accessories:

- 1 ea Model 1900.1155US Water Filtration Cartridge, replacement or add on with additional Modular Head to Double Cartridge System, includes: (1) R95-CL filter

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 43 - WALL SHELVING UNITS (2 REQ'D)**

Advance Tabco Model WS-12-72-16

Shelf, wall-mounted, 72"W x 12"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 44 - WORK TABLE (1 REQ'D)**

Advance Tabco Model KMS-306

Work Table, 72"W x 30"D, 16 gauge 304 stainless steel top with 5"H backsplash, 18 gauge stainless steel adjustable undershelf, stainless steel legs & adjustable bullet feet, NSF

Accessories:

2 ea Model SHD-2020 Drawer, 20"W x 20"D x 5" deep drawer pan insert, heavy duty, self-closing, stainless steel, NSF

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 45 - CABINET, COOK / HOLD / OVEN (1 REQ'D)**

Alto-Shaam Model 1000-TH/I

Halo Heat® Slo Cook & Hold Oven, electric, low-temperature, two compartments, 120 lb. capacity each - (4) full-size pans per cavity, simple controller with timer, heavy-duty stainless steel, 5" casters; 2 rigid, 2 swivel with brakes, EcoSmart®, cULus, NSF, CE, IPX3, TUV NORD

Accessories:

2 ea Reach-in design

2 ea Solid Door, hinged per plan

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 46 - COMBI OVEN (1 REQ'D)**

RATIONAL Model ICP 6-HALF NG 120V 1 PH

(CB1GRRA.0000230) iCombi Pro® 6-Half Size Combi Oven, natural gas, (6) 13" x 18" sheet pan or (6) 12" x 20" steam pan or (6) 1/1 GN pan capacity, intelligent cooking system with (4) assistants; iDensityControl, iCookingSuite, iProductionManager, & iCareSystem, (6) operating modes, (5) cooking methods, (3) manual operating modes, 85° to 572°F temperature range, quick clean, care control, eco mode, 6-point core temperature probe, retractable hand shower, Ethernet interface, Wi-Fi enabled, 49,500 BTU, 6 ft. cord, CE, IPX5, cCSAus, NSF, ENERGY STAR®

Accessories:

- 1 ea 2 years parts and labor, 5 years steam generator warranty
- 1 ea Model CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 47 - WATER FILTRATION SYSTEM, CARTRIDGE KIT (1 REQ'D)**

RATIONAL Model 1900.1150US

Water Filtration Double Cartridge System, for full-size Combi-Duos or if used for more than (2) units, includes: (1) double head with pressure gauge, (2) R95-CL filter & (1) filter installation kit (for each additional unit add (1) additional head & additional cartridge. Maximum (4) cartridges)

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 48 - CHARBROILER (1 REQ'D)**

Imperial Model IRB-36

Charbroiler, gas, countertop, 36"W, (6) radiant burners, cast iron slanted top grates, full width grease gutter, removable drip pan, stainless steel front, sides & 5"D landing ledge, 4" legs with adjustable feet, 90,000 BTU, cETLus, NSF, CE

Accessories:

- 1 ea Limited one year parts and labor warranty
- 1 ea Quick disconnect & flex hose with restraining device, 3/4" N.P.T. x 60"

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 49 - REFRIGERATED BASE (1 REQ'D)**

True Mfg. - General Foodservice Model TRCB-82-84-HC

Refrigerated Chef Base, 82-3/8"W base, 84"W one-piece 300 series 18 gauge stainless steel top with V edge, (4) drawers (left drawer accommodates (3) and right drawer accommodates (2) 12" x 20" x 4" pans, NOT included), stainless steel front/sides, aluminum back, aluminum interior with stainless steel floor, 4" castors, R290 Hydrocarbon refrigerant, 1/3 HP, 115v/60/1-ph, 4.4 amps, NEMA 5-15P, cULus, UL EPH Classified, CE, Made in USA

Accessories:

- 1 ea Self-contained refrigeration
- 1 ea 7 year compressor warranty, 6 years parts warranty, 5 year labor warranty
- 1 ea 16 gauge heavy duty Stainless steel top
- 1 ea 4" Castors

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 50 - SALAMANDER BROILER (1 REQ'D)**

Imperial Model IRSB-36

Pro Series Salamander Broiler, 36"W, infra-red burner, (4) locking positions, protective screen, metal control knob, stainless steel top, front, bottom & sides, 40,000 BTU, NSF, CE, CSA Flame, CSA Star

## Accessories:

- 1 ea Limited one year parts and labor warranty
- 1 ea Wall mount brackets

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 51 - GRIDDLE (1 REQ'D)**

Imperial Model ITG-36

Griddle, countertop, gas, 48"W x 24"D cooking surface, 1" thick polished steel plate, (4) griddle burners, continuous pilot, aeration baffles, thermostatic controls, 4"W grease gutter, removable 1 gallon grease can with weep hole, full width rear flue, stainless steel front, sides, splash guard & ledge, 4" stainless steel legs, 120,000 BTU, 35W, cETLus, NSF, CE

## Accessories:

- 1 ea Limited one year parts and labor warranty
- 1 ea Quick disconnect & flex hose with restraining device, 3/4" N.P.T. x 60"

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 52 - 2-FRYERS W/ FILTER SYSTEM (1 REQ'D)**

Pitco Frialator Model SG14RS-2FD

Solstice™ Prepackaged Fryer System with Solstice™ Filter Drawer System, High Power, gas, (2) 50 lb. oil capacity full tanks, millivolt control, stainless steel tank, front & sides, under-fryer drawer filtration, total 244,000 BTU (-FF), NSF, CE, CSA Flame, CSA Star, AuGA

## Accessories:

- 1 ea 1 year parts and labor warranty from the date of installation up to a maximum of 15 months from the date of manufacture (with appropriate documentation)
- 1 ea Millivolt Thermostat, standard
- 1 ea Contact factory for cord information
- 1 ea Model P6072145 Basket, (2) oblong/twin size, 13-1/2" x 6-1/2" x 5-3/4" deep, long handle, regular mesh
- 1 st Model B3901504 Casters, 9" adjustable swivel non-lock rear & lock front casters, for battery of (2) Solstice gas and electric fryers, batteries and retherms
- 1 ea Model B8003103 Gas Connector Hose, 3/4" connection, 48" long, with quick disconnect couplings, restraining device & thermal shut-off, for single unit 240,000 BTU

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 53 - WORKTOP FREEZER (1 REQ'D)**

Turbo Air Model TWF-28SD-D2-N

Super Deluxe Worktop Freezer, one-section, 7.0 cu. ft., self-cleaning condenser equipped, (2) stainless steel drawers with recessed handles, accommodates pans up to 6" deep, capacity: (1) full size pan or (3) 1/3 size pans or (6) 1/6 size pans per drawer (NOT included), stainless steel interior & exterior, self-contained rear mounted refrigeration system, R290 Hydrocarbon refrigerant, 2/5 HP, , cETLus, ETL-Sanitation

**Accessories:**

- 1 ea 5 year parts & labor warranty
- 1 ea 7 year compressor warranty (self-contained only)
- 1 ea Self-cleaning condenser device equipped
- 1 ea Drawer pan support bars included
- 1 st Caster Set, swivel, locking front wheels

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 54 - CORNER GUARDS & WALL CAPS (1 It REQ'D)**

Custom Fabricated Stainless Steel

304 18 ga S/S construction from cove base to ceiling. 2" x 2" angle with hug edges.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 55 - EXHAUST HOOD (1 REQ'D)**

Captive-Aire Model ND-2-PSP-F

S/S construction, S/S type grease filters, front eye brow make-up air plenum. Hoods to be pre-piped for fire suppression system. See manufacturer Data sheet for additional information.

1. Stainless steel construction where exposed
2. Hood to be UL listed
3. Stainless steel Captrate Solo type baffle filters.
4. Provide stainless steel closure panels from top of hood to building ceiling
5. Incandescent light fixtures w/ wire lamp guards located as shown on plans
6. Mount unit to overhead building structure w/ bottom of hood at 78" above finished floor

Provide to site in crated for installation by G.C. Coordinate delivery schedule with G.C. Item should be provided with all accessories listed and shown on hood submittal pans in FS plan set and meet utility requirements listed on rough-in plans.

**ITEM 56 - ELECTRICAL CONTROL PACKAGE (1 REQ'D)**

Captive-Aire Model DCV-21111

Standard controls, temperature sensor activated, Ventilation control for Exhaust Fans, Supply Fan, Exhaust on in Fire, Lights out in Fire, Fans modulate based on duct temperature. INVERTER DUTY THREE PHASE MOTOR REQUIRED! Room temperature sensor shipped loose for field installation. Includes Duct Thermostat kits.

Provide and install in location shown on plan and per manufactures recommendations complying with all

local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 57 - TRASH RECEPTACLE (5 REQ'D)**

Rubbermaid Commercial Products Model FG354060GRAY

Slim Jim® Container, 23 gallon, 22"W x 11"D x 30"H, with venting channels, molded-in handles, general purpose waste, open type without lid, high-impact plastic construction, gray, Made in USA

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 58 - CONVEYOR TOASTER (1 REQ'D)**

Hatco Model TQ-800

Toast-Qwik® Conveyor Toaster, horizontal conveyor, countertop design, all bread types toaster, approximately 14 slice capacity/min, 2" opening height, rotary mechanical controls, colorguard sensing system, CE, cULus, UL EPH Classified, Made in USA

Accessories:

1 ea One year on-site parts & labor warranty, plus one additional year parts only warranty on all Toast-Qwik metal sheathed elements

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 59 - REFRIGERATED PEREP TABLE (2 REQ'D)**

Continental Refrigerator Model SW60N24M-D

Mighty Top Sandwich Unit, 60"W, 17.0 cu ft capacity, two-section, (24) 1/6 size x 4" deep pans with 8" cutting board, (4) drawers, accommodates (1) 12 x 20 x 6 pan per drawer (supplied by others), stainless steel top, front & end panels, aluminum back & interior, rear mounted self-contained refrigeration, automatic hot gas condensate evaporator, R290 hydrocarbon refrigerant, 1/3 HP, cETLus, NSF

Accessories:

2 ea 3 year parts and labor; additional 4 year compressor part  
2 ea Casters, 5"

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 60 - HOT FOOD WELL UNIT, BUILT-IN, ELECTRIC (1 REQ'D)**

Wells Model MDW500

Food Warmer, top-mount, built-in, electric, (5) 12" x 20" pan opening, dry operation, individual infinite control, stainless steel construction, Wellslok system, UL EPH Classified, cULus, MADE in USA

Accessories:

1 ea Warranty: 1 year parts and labor  
1 ea (5) 3-ph, field wired (field convertible)

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 61 - DOUBLE PASS SHELF (1 REQ'D)**

Custom Fabricated Stainless Steel

304 16 ga S/S construction with utility raceway for P.O.S. comm cables, fixture mounted receptacles and conduit to utility chases at ends.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 62 - EXPO COUNTER (1 REQ'D)**

Custom Fabricated Stainless Steel

304 14 ga S/S top with 18 ga S/S cabinet base, 6" S/S legs. Provide with storage cabinet base with mid shelf, apron for hot well controls. Provide with utility raceway and fixture mounted outlets with conduit to connection point as shown in electrical drawings for counter mount equipment.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 63 - EXPO COUNTER (1 REQ'D)**

Custom Fabricated Stainless Steel

304 14 ga S/S top with 18 ga S/S cabinet base, 6" S/S legs. Provide with storage cabinet base with mid shelf, apron for hot well controls. Provide with utility raceway and fixture mounted outlets with conduit to connection point as shown in electrical drawings for counter mount equipment.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 64 - P.O.S.PRINTER (4 REQ'D)**

P.O.S. PRINTER - N.I.K.E.C. SUPPLIED & INSTALLED BY OPERATOR

**ITEM 65 - PENDANT HEAT LAMPS (8 REQ'D)**

Hatco Model DL775RTLBB-BK.1

DL-775-RTL (QUICK SHIP MODEL) Decorative Heat Lamp, bold black, 8-1/2"H x 10-1/2" diameter shade, includes: black cord, black track adapter, lower switch & coated bulb, max, cULus, UL EPH Classified

Accessories:

8 ea 1 year parts & labor warranty

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.



**ITEM 66 - REFRIGERATOR (1 REQ'D)**

Continental Refrigerator Model 2RNSA

Refrigerator, reach-in, two-section, self-contained refrigeration, stainless steel exterior, aluminum interior, standard depth, full-height solid doors, cylinder locks, electronic control with digital display, hi-low alarm, electric condensate evaporator, R290 hydrocarbon refrigerant, 1/3 HP, cETLus, NSF, ENERGY STAR®

Accessories:

2 ea 3 year parts and labor; additional 4 year compressor part

2 ea Left Door hinged on left & right door hinged on right

2 ea 5" Casters, standard

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 67 - GLASS FILLER STATION (1 REQ'D)**

Fisher Model 1400

Glass Filler, with sink assembly, 10" pedestal type, single service, stainless steel drain trough, wire grate, stainless steel stream strainer (8" clearance from grill to outlet), CSA-Sanitation ANSI/NSF 61, section 9 certified

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 68 - SODA DISPENSER (2 REQ'D)**

SODA DISPENSER, N.I.K.E.C. SUPPLIED & INSTALLED BY VENDOR

**ITEM 69 - WALL SHELF (4 REQ'D)**

Custom Fabricated Stainless Steel

Shelf, wall-mounted, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304, support brackets, satin finish stainless steel, NSF

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 70 - JUICE DISPENSER, ELECTRIC (1 REQ'D)**

BUNN Model 37300.0004

37300.0004 JDF-4S Silver Series® 4-Flavor Cold Beverage System, (3) 12 oz. drinks/min capacity, 2-modular dispense decks, 18 lb. ice bank, 7" cup clearance, dispense 1.0 to 1.5 ounces per second flow rate, pumps & mixes 2+1 to 11+1 concentrated beverages, 4+1 high viscosity & 5+1 juices, dispenses frozen and ambient products, High Intensity™ mixing technology, push button and portion control, LED lighted door graphics, door lock, juice display, , NSF, ETL

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 71 - COFFEE BREWER (2 REQ'D)**

BUNN Model 20900.0011

20900.0011 Dual® Coffee Brewer, Portable, mechanical thermostat, brews 18.9 gallons per hour capacity, stainless steel funnel, 3 batch-size settings, electronic timer & grinder interface, upper hot water faucet, variable water bypass, includes (2) GPR servers (20950.0004), 4" black adjustable legs, 120/UL, NSF

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 72 - COFFEE GRINDER (2 REQ'D)**

BUNN Model 35600.0020

35600.0020 MHG, SST Multi-Hopper Grinder & Storage System, front loading dual 6 lbs. removable hopper, portion control, 3 batch sizes per hopper, racks & LCD alphanumeric display, precision burrs, locking lid (lock sold separately), stainless steel, tall model accommodates large brew funnels, 3/4 HP, , cord attached, UL, ETL

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 73 - ICED TEA BREWER (2 REQ'D)**

BUNN Model 36700.0041

36700.0041 TB3Q/TD4T Iced Tea Brewer, 3-gallon capacity single brewer, 26.7 gallon/hour, SplashGard® funnel, Quickbrew system, includes (1) TD4T dispenser (03250.0005) (other dispensers sold separately) , cord attached, UL, NSF

Accessories:

4 ea TD4T Dispensers

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 74 - U/C REFRIGERATOR (1 REQ'D)**

Continental Refrigerator Model SW48N

Work Top Refrigerator, 48"W, 13.4 cu ft capacity, two-section, stainless steel flat top, (2) field rehingeable doors, stainless steel front & end panels, aluminum interior, rear mounted self-contained refrigeration, R290 Hydrocarbon refrigerant, 1/5 hp, cETLus, NSF, ENERGY STAR®

Accessories:

1 ea 3 year parts and labor; additional 4 year compressor part

1 ea Left Door hinged on left & right door hinged on right

1 st Model 50301 Casters, swivel, with brakes (3" diameter rubber tires) set of 4 (3-3/4" height)

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 75 - BEVERAGE COUNTER (1 REQ'D)**

Custom Fabricated Stainless Steel

Stainless steel base, 304 18 ga S/S cabinet base construction with 6" S/S legs. Provide with doors, 16 ga S/S mid shelves and panels per plans & elevations.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 76 - COMMERCIAL WASTE CONTAINER (3 REQ'D)**

Rubbermaid Commercial Products Model FG263256GRAY

BRUTE® Food Processing Container, without lid, 32 gallon, 22"D x 27-1/4"H, with "Inedible" black imprint, reinforced rims, built in handles, double rimmed base, high-impact plastic construction, gray , NSF, Made in USA

Accessories:

3 ea Model FG264000BLA Brute® Dolly, 18-1/4"D x 6-5/8"H, heavy duty 3" casters, 250 lb. capacity,  
3 ea San Jamar Model KA3244 KatchAll® Flatware Retriever, 25" x 9-1/2", fits 32 & 44 gallon round can, dishwasher safe, plastic (does not attract 18/8 or 18/10 silverware)

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 77 - SOILED DISHTABLE W/SCRAP SINK (1 REQ'D)**

Custom Fabricated Stainless Steel

304 14 ga S/S construction, straight design with 20" x 20" x 7" fully welded sink bowl with perforated scrap basket and rack glides. S/S legs and cross rail support base, 10" back splash.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 78 - DOUBLE SIDED DISH RACK SORTING SHELF (1 REQ'D)**

Custom Fabricated Stainless Steel

304 16 ga S/S construction with tubular S/S rack storage overshef with S/S "L" angle rack stop on operator side. Double sided design with rolled edge lower gutter with drain holes at 6" O.C.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 79 - DISPOSER (1 REQ'D)**

Salvajor Model 200-SA-6-ARSS

Disposer, Sink Assembly, 6-1/2" sink collar, 2 Hp motor, start/stop push button, drain/flush/time delay, automatic reversing & water saving ARSS control, includes fixed nozzle, chrome plated vacuum breaker, solenoid valve, sink stopper & flow control, heat treated aluminum alloy housing, UL, CSA, CE

Accessories:

1 ea Model 980105 Mounting bracket  
1 ea Model LSA8 Disposer support leg, for 3/4 HP - 2 HP disposers

1 ea Model DP Stainless steel dejamming prong

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 80 - PRE-RINSE FAUCET ASSEMBLY (1 REQ'D)**

Fisher Model 2210-WB

Pre-Rinse Assembly, 8" adjustable centers, wall-mounted mixing valve, with spring action flexible gooseneck, with Ultra-Spray™/PLUS spray valve (1.15 gallons per minute @ 60 PSI), with wall bracket

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 81 - S/S WALL FLASHING (1 REQ'D)**

Custom Fabricated Stainless Steel

304 18 ga S/S construction from cove base to ceiling with "T" trim strip moldings.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 82 - DISHWASHER, CONVEYOR TYPE (1 REQ'D)**

Champion Model 44 PRO

Pro Series, 44"W rack conveyor dishwasher, Proportional Rinse, Progressive anti-jam drive system, top mounted Prodigy series HMI user interface, Proactive maintenance software, 100 gallons per hour with energy sentinel (idle pump shut-off), (209) racks per hour, single-piece hood design, single-piece stainless steel upper & lower wash arms manifolds, internal removable scrap basket, dual-piece scrap screens, 20" standard vertical clearance which accommodate 18" x 26" sheet pans, full 180° opening leak proof insulated hinged access doors, automatic tank fill, door safety switches, leak-proof ball valve drains, lower front & side enclosure panels, stainless steel heavy gauge construction including base & legs, electric tank heat, 2 HP wash pump, single point machine & booster connection, vent fan control, stainless steel rear manifolds, includes: (1) 20" x 20" peg rack & (1) 20" x 20" flat rack, NSF, cULus, ENERGY STAR®, Made in USA

Accessories:

1 ea 1 year parts & labor warranty

1 ea Complimentary factory authorized performance test included, upon equipment start-up. Consult local Champion sales representative for coordination of the start-up. If customer is beyond 60 miles from Champion authorized service agent, consult factory.

1 ea Electric tank heat

1 ea Electric booster, 70° rise, 21kW, built-in

1 ea 20" High hood vertical clearance for sheet pans (standard)

1 ea Table limit switch, whisker style (unmounted) (traditional)

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 83 - RACK DOLLY (2 REQ'D)**

Cambro Model CD2020110 Dimensions: 8.25(h) x 22.5(w) x 22.5(d)  
Camdolly®, 22-1/2"L x 22-1/2"W x 8-1/4"H (exterior dimensions), without handle, polyethylene construction, (4) 3" heavy duty swivel casters, load capacity 300 lbs., black, NSF

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 84 - CLEAN DISHTABLE (1 REQ'D)**

Custom Fabricated Stainless Steel  
304 14 ga S/S construction, 10" back & left end splash, 3" sanitary rolled edge. Provide with S/S legs and cross rail base.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 85 - CONDENSATE HOOD (1 REQ'D)**

304 18 ga S/S construction with full perimeter gutter and removable wire mesh filter. Refer to manufacturer shop drawings for additional specification and information.

Provide to site in crated for installation by G.C. Coordinate delivery schedule with G.C. Item should be provided with all accessories listed and shown on hood submittal pans in FS plan set and meet utility requirements listed on rough-in plans.

**ITEM 86 - OVERSHELF (1 REQ'D)**

Advance Tabco Model PS-12-84  
Shelf with Pot Rack, wall-mounted, 84"W x 12"D, 18/430 stainless steel shelf, 2" x 1/4" stainless steel pot rack, includes: (9) plated double pot hooks, NSF

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 87 - THREE (3) COMPARTMENT SINK (1 REQ'D)**

Advance Tabco Model FC-3-1824-24RL  
Fabricated Sink, 3-compartment, 24" right & left drainboards, bowl size 18" x 24" x 14" deep, 16 gauge 304 stainless steel, tile edge splash, rolled edge, 8" OC faucet holes, stainless steel legs with adjustable side cross-bracing, 1" adjustable stainless steel bullet feet, overall 30" F/B x 102" L/R, NSF

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 88 - WALL SHELVING UNITS (2 REQ'D)**

Advance Tabco Model WS-12-36-16

Shelf, wall-mounted, 36"W x 12"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

#### **ITEM 89 - SPARE NUMBER**

#### **ITEM 90 - WIRE SHELVING UNIT (2 REQ'D)**

Metro Model EPOXY

Super Erecta® Starter Shelving Unit, (4) posts, Metroseal Green finish, KD, NSF. See FS Plan for size & configuration.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

#### **ITEM 91 - WATER FILTRATION SYSTEM (2 REQ'D)**

3M Purification Model BEV130

(5616101) 3M™ Water Filtration Products Water Filter System, 21-1/4"H x 4-1/2"D, valve-in-head, standard water, single vessel, 0.5 micron, 1.67 gpm flow rate, 14,000 gallons capacity, reduces sediment, chlorine taste & odor, cyst, SQC style, internal automatic 1/4 turn shut-off valve, includes: (1) integral mounting bracket, (1) pressure gauge, and (1) cartridge filter, 3/8" FNPT connections, NSF certified (for single carbonator cold beverage dispensers)

Accessories:

2 ea Model HF30 (5615105) 3M™ Water Filtration Products Replacement Cartridge, extended length, 0.5 micron, 1.67 gpm flow rate, 14,000 gallons capacity, reduces sediment, chlorine taste & odor, cyst reduction for 5616101, NSF certified

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

#### **ITEM 92 - WALL SHELVING UNITS (2 REQ'D)**

Advance Tabco Model WS-12-48-16

Shelf, wall-mounted, 48"W x 12"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

#### **ITEM 93 - TRASH RECEPTACLE (1 REQ'D)**

Rubbermaid Commercial Products Model FG263200GRAY

ProSave® BRUTE® Container, without lid, 32 gallon, 22"D x 27-1/4"H, round, reinforced rims, built in handles, double rimmed base, high-impact plastic construction, gray, NSF, Made in USA

Accessories:

1 ea Model FG264000BLA Brute® Dolly, 18-1/4"D x 6-5/8"H, heavy duty 3" casters, 250 lb. capacity

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 94 - COFFEE DISPENSER (4 REQ'D)**

Thermal Dispenser, 2.0 gallon, Freshness Timer®, Volume Indicator™, vacuum insulated, flip & hide fill-through lid, base with built-in handles and drip tray

Accessories:

4 ea FETCO NOTE: Pricing and specifications subject to change with or without notice

4 ea FETCO 1 year parts warranty

4 ea FETCO Black dispenser faucet

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 95 - BEVERAGE COUNTER (1 REQ'D)**

Custom Fabricated Stainless Steel

304 14 ga S/S top with 6" back and side splashes, (1) 16" x 20" x 12" fully welded . 304 18 ga S/S cabinet base construction with 6" S/S legs. Provide with doors, 16 ga S/S mid shelves and panels per plans & elevations.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

Accessories:

1 ea Krowne Model 18-725L Krowne Royal Series ShelfMaster Pre-Rinse Assembly, with add-on faucet, wall mount, 8" centers, 23-3/4"H stainless steel hose with 15" overhang & 1.15 GPM spray head, built in check valves, 1.8 GPM add-on faucet with 12" swing spout, includes wall bracket & mounting kit, chrome plated brass base, NSF, cCSAus, ADA Compliant

1 ea Krowne 3 year warranty

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 96 - MICROWAVE OVEN (3 REQ'D)**

ACP Model RCS10TS

Amana® Commercial Microwave Oven, 1.2 cu. ft. capacity, medium volume, 4-stage cooking, (5) power levels, (100) memory settings, braille touch pads, non-removable air filter, side hinged door with tempered glass, accommodates 14" plate, stainless steel interior & exterior, 15 MCA, (total), , cETLus, ETL-Sanitation

Accessories:

3 ea 3-year limited warranty (1 year full)

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 97 - MICROWAVE OVEN, SHELF (1 REQ'D)**

Advance Tabco Model MS-18-24

Microwave Shelf, wall-mounted, 24"W x 18"D, stainless steel, NSF

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 98 - PENDANT HEAT LAMPS (5 REQ'D)**

Hatco Model DL775RTLBB-BK.1

Decorative Heat Lamp, bold black, 8-1/2"H x 10-1/2" diameter shade, includes: black cord, black track adapter, lower switch & coated bulb, max, cULus, UL EPH Classified

Accessories:

5 ea 1 year parts & labor warranty

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 99 - PLATING TABLE (1 REQ'D)**

Custom Fabricated Stainless Steel

304 14 ga S/S top, S/S legs and 16 ga undershelf. Provide with 16 ga S/S overshelf. Provide with white poly cutting boards per plans and elevations.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 100 - HOT PLATING TABLE (1 REQ'D)**

Custom Fabricated Stainless Steel

304 14 ga S/S top with cut out for drop-in heated wells. S/S legs and 16 ga undershelf. Provide with 16 ga S/S overshelf. Provide with S/S tubular wire chase for electrical plug access. Provide with cutting boards and S/S apron for hot food well controls per plans and elevations.

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 101 - DROP-IN HOT FOOD WELL (1 REQ'D)**

Alto-Shaam Model 300-HWIS/D6

Halo Heat® Hot Food Well Unit, Drop-In, Electric, 65-5/8"W x 14-15/16"D, (3) 12" x 20" full-size pan capacity (pans NOT included), 6-3/8" deep well, holds 6" deep pans, (3) individual adjustable thermostatic controllers, stainless steel construction, EcoSmart®, cULus, UL EPH Classified, CE, IPX3, TUV NORD, EAC



Accessories:

- 1 ea 6 ft. cord and plug
- 1 ea Cord located on back of control box

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 102 - MOBILE HEATED CABINET (1 REQ'D)**

Cres Cor Model H135SUA11

Cabinet, Mobile Heated, one compartment, insulated, bottom-mount heater assembly, field reversible dutch doors, recessed push/pull handles, (11) sets of chrome plated wire universal angle slides on 4-1/2" centers, adjustable 1-1/2" centers, analog thermometer, anti-microbial latches, stainless steel construction, (4) 5" swivel casters (2) braked, CSA-Sanitation, cCSAus

Accessories:

- 1 ea 1 year labor, 2 years parts warranty
- 1 ea 6 ft 14/3 ga. power cord
- 1 ea Right-hand door swing (top & bottom doors)

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 103 - REACH-IN FREEZER (1 REQ'D)**

Continental Refrigerator Model D1FN5A

Designer Line Freezer, reach-in, one-section, 21.0 cu. ft., self-contained refrigeration, stainless steel exterior, aluminum interior, standard depth cabinet, full-height solid door, cylinder lock, electronic control with digital display, hi-low alarm, 6" stainless steel legs, R290 hydrocarbon refrigerant, 1/2 HP, cETLus, NSF

Accessories:

- 1 ea 3 year parts and labor; additional 2 year compressor part
- 1 ea cord and plug
- 1 ea Door hinged per plan
- 1 ea 6" stainless steel adj. legs

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 104 - FLOOR TROUGH (1 REQ'D)**

Eagle Group Model ASFT-1248-FG

Anti-Splash Floor Trough, 48"W x 12"D, yellow fiberglass subway-style grating with non-slip surface, 6" deep trough pan with built-in pitch toward drain, accommodates up to a 4" diameter drain pipe, stainless steel removable perforated basket, all-welded 14/304 stainless steel construction, NSF

Accessories:

- 1 ea Model G (FT) Gray fiberglass grating

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 105 - ICE MAKER, CUBE-STYLE (1 REQ'D)**

Manitowoc Model IYT1900A

Indigo NXT™ Series Ice Maker, cube-style, air-cooled, self-contained condenser, 48"W x 24"D x 29-1/2"H, production capacity up to 1965 lb/24 hours at 70°/50° (1535 lb AHRI certified at 90°/70°), easyTouch display with 13 different language options, date/time stamp display, automatic reminder/alert icon, one touch asset information, automatic detection of accessories, continuous operating status, programmable production options (time, weight, day or night), one touch cleaning with displayed instructions, Alpha-San anti-microbial protection, acoustical ice sensing probe, self-diagnostic technology, DuraTech™ exterior, half-dice size cubes, R410 refrigerant, NSF, cULus, CE

Accessories:

1 ea            3 year parts & labor (Machine), 5 year parts & labor (Evaporator), 5 year parts & 3 years labor (Compressor)

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 106 - ICE BIN FOR ICE MACHINES (1 REQ'D)**

Follett Products, LLC Model SG1300S-48

Upright Ice Bin, single door, 1320 lb. bin storage capacity, stainless exterior, poly liner, SmartGATE™ ice shield, poly door with PowerHinge, and corrosion-resistant ABS/poly top custom cut for ice machine, includes 82 oz. plastic ice scoop, NSF

Accessories:

1 ea    5 year parts & labor warranty  
1 ea    Model ABICESCOOP Ice Scoop, poly, 82 oz  
1 st    Model ABSPECLEG3 Legs, 6", stainless steel, flanged (set of 4) for slope front bins, and single door and double door upright bins

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 107 - WATER FILTRATION SYSTEM, FOR ICE MACHINES (1 REQ'D)**

3M Purification Model ICE195-S

(5616404) 3M™ Water Filtration Products Water Filter System, with shut-off valve & gauge, 23-5/8"H x 5"D, high turbidity water, single vessel, max pressure of 125 psi at 100°F, 3 micron, 5 gpm flow rate, 54,000 gallons capacity, for sediment, chlorine taste & odor, scale, includes: (1) integral mounting bracket and (1) o-ring seal cartridge filter, 1/2" FNPT connections, NSF certified

Accessories:

1 ea    Model HF95-S (5613509) 3M™ Water Filtration Products Replacement Cartridge, large diameter, 3 micron, 5 gpm flow rate, 54,000 gallons capacity, reduces sediment, chlorine taste & odor, scale inhibitor (for ICE195-S), NSF certified

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 108 - ROLL-IN REFRIGERATOR (1 REQ'D)**

Continental Refrigerator Model D2RINSA

Designer Line Refrigerator, roll-in, two-section, self-contained refrigeration, stainless steel exterior, aluminum interior, standard depth cabinet, full-height solid doors, cylinder locks, electronic control with digital display, hi-low alarm, removable stainless steel ramps, R290 hydrocarbon refrigerant, 1/2 HP, cETLus, NSF

Accessories:

1 ea 3 year parts and labor; additional 4 year compressor part

1 ea cord & plug

1 ea Doors hinged per plan

Provide and install in location shown on plan and per manufactures recommendations complying with all local codes and regulations. Item should be provided with all accessories listed and meet utility requirements listed on rough-in plans.

**ITEM 109 - SPARE NUMBER**

**ITEM 110 - SPARE NUMBER**

**END OF SECTION**

**SECTION 11 5213  
PROJECTION SCREENS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Front projection screen assemblies.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 5100 - Acoustical Ceilings: Suspended panel ceilings for recessed screens.
- B. Section 26 0583 - Wiring Connections: Electrical supply, conduit, and wiring for electric motor operated projection screens.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Shop Drawings: For custom installations, indicate dimensions, verified field measurements, mounting details, and interface with adjacent construction.
- D. Samples: For screen fabrics, submit two samples 6 by 6 inch in size.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.
- H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver projection screens to project site in manufacturer's original unopened packaging, and inspect for damage and proper size before accepting delivery.
- B. Store in a protected, clean, dry area with temperature maintained above 50 degrees F, and stack in accordance with manufacturer's recommendations.
- C. Acclimate screens to building temperatures for 24 hours prior to installation, in accordance with manufacturer's recommendations.

**1.06 FIELD CONDITIONS**

- A. Maintain interior of building between 60 degrees F and 90 degrees F during and after installation of projection screens.

**1.07 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 10 year manufacturer warranty for projection screen assembly.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Draper, Inc; Basis of design: Rolleramic 70" x 70": [www.draperinc.com](http://www.draperinc.com).

### **2.02 FRONT PROJECTION SCREENS**

- A. Manufacturers:
  - 1. Draper, Inc (Motorized); Premier: [www.draperinc.com/#sle](http://www.draperinc.com/#sle).
- B. Front Projection Screens: Factory assembled unless otherwise indicated.
  - 1. Located in, Ballroom 509: 197 in wide. Motorized, matte light diffusing fabric screen, horizontally tensioned, ceiling recessed.
  - 3. Located in Boardroom 502: 106 in wide. Motorized, matte light diffusing fabric screen, horizontally tensioned, wall mounted.
    - a. Screen Viewing Area: 62 inch high by 62 inch wide
    - b. Products: Envoy manufactured by Draper.
- C. Concealed-in-Ceiling Screen Cases: Steel, with integral roller brackets.
  - 1. Door Slat: Self trim; self-closing and -opening.
  - 2. Case Finish: Baked enamel.
  - 3. Case Color: White.
  - 4. End Caps: Steel; finished to match case.
  - 5. Electrically-Operated Screens: 1-1/2 inch aluminum door roller.
  - 6. Mounting: Ceiling recessed.
- D. Exposed Screen Cases: Steel, with integral roller brackets.
  - 1. Finish: Baked enamel.
  - 2. Color: White.
  - 3. End Caps: Steel; finished to match case.
  - 4. Mounting: Wall
- E. Electrically-Operated Screens:
  - 1. Roller: Steel, 2 inch in diameter, with locking device.
  - 2. Vertical Tensioning: Screen fabric weighted at bottom with steel bar and plastic end caps.
  - 3. Horizontal Tensioning: Tab-guided cable system.
- F. Provide mounting hardware, brackets, supports, fasteners, and other mounting accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

### **2.03 ELECTRICAL COMPONENTS**

- A. Electrical Components: Listed and classified by UL as suitable for the purpose specified and indicated.
- B. Motors: Direct drive, 110 V, 60 Hz.
  - 1. Screen Motor: Mounted inside roller; three wire with ground; quick reverse type and lifetime lubricated; equipped with thermal overload cut-off, internal junction box, electric brake, and pre-set accessible limit switches.
    - a. Electrical Characteristics: 1.2 amps.
    - b. Motor mounted on sound absorber.
  - 2. Door and Adjustable Masking Motor: Mounted inside roller; three wire with ground; quick reverse type; equipped with thermal overload cut-off.
    - a. Electrical Characteristics: 1.2 amps.
- C. Controls: Three (3) position control switch with plate.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate is finished and ready to accept screen installation.

- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that openings for recessed screens are correctly sized.
- D. Verify type and location of electrical connections.

### **3.02 PREPARATION**

- A. Coordinate screen installation with installation of projection systems.
- B. Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, and registers and grilles.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.
- B. Do not field cut screens.
- C. Install screens in mountings as specified and as indicated on drawings.
- D. Install plumb and level.
- E. Install electrically operated screens ready for connection to power and control systems by others.
- F. Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.
- G. Test electrical screens for proper working condition. Adjust as needed.

### **3.04 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch up, repair, or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**SECTION 12 2413  
ROLLER SHADES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Manually operated sunscreen roller shades.
- B. Manually operated double sunscreen and room darkening roller shades
- C. Electrically operated sunscreen roller shades.
- D. Electrically operated room-darkening shades.
- E. Local group and master control system for shade operation with addressable motors.

**1.2 RELATED SECTIONS**

- A. Section 061053 - Miscellaneous Carpentry: Wood blocking and grounds for mounting roller shades and accessories.
- B. Section 092216 - Non-Structural Metal Framing and Section 09 29 00 Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.
- C. Section 095100 - Acoustical Ceilings: Coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.
- D. Division 16 - Electrical: Electric service for motor controls.

**1.3 REFERENCES**

- A. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. NFPA 70 - National Electrical Code.
- C. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.

**1.4 SUBMITTALS**

- A. Submit under provisions of Section 01300.  
Submit Environmental Certification and Third Party Evaluation per Section 1.5 Qualifications.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
  - 3. Storage and handling requirements and recommendations.
  - 4. Mounting details and installation methods.
  - 5. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual and lighting control systems as applicable.
  - 6. Signed letter from the manufacturer stating the subcontractor is an authorized dealer and will be providing shades for this project.

- C. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
- D. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shadecloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.
- F. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
- G. ShadeCloth Cleanability and Disinfecting: ShadeCloth must meet cleanability and disinfecting requirements via independent and certified 3<sup>rd</sup> party testing lab which complies with BIFMA HCF 8.1-2014 standards using chemical solutions compliant with EPA guidelines for use against COVID-19, outlining approved and applicable chemicals and percentage of applicable concentrations by fabric content and type.
- H. Installer must provide a signed letter from the manufacturer stating they are an authorized dealer and must provide a copy of their subcontractor's license proving they have been in the window covering business for fifteen years.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.
- B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of fifteen years in the window covering business (based on the issue date of the subcontractor license) in the state of the project with a minimum of fifteen years experience in installing products comparable to those specified in this section. Installer must have completed a minimum of five comparable projects. Installer must provide a signed letter from the manufacturer stating they are an authorized dealer and must provide a copy of their subcontractor's license proving they have been in the window covering business for fifteen years.
- C. Fire-Test-Response Characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.
- E. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.
- F. ShadeCloth Cleanability and Disinfecting: ShadeCloth must meet cleanability and disinfecting requirements via independent and certified 3<sup>rd</sup> party testing lab which complies with BIFMA HCF 8.1-2014 standards using chemical solutions compliant with EPA guidelines for use against COVID-19, outlining approved and applicable chemicals and percentage of applicable concentrations by fabric content and type.



- G. Mock-Up: Provide a mock-up (manual shades only) of one roller shade assembly for evaluation of mounting, appearance and accessories.
  - 1. Locate mock-up in window designated by Architect.
  - 2. Do not proceed with remaining work until, mock-up is accepted by Architect.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

## 1.8 WARRANTY

- A. Provide manufacturer's standard warranties, including the following: Roller Shade Hardware and Shadecloth (except EcoVeil™): Manufacturer's standard non-depreciating twenty-five year limited warranty.
  - 1. EcoVeil standard non-depreciating 10-year limited warranty.
- B. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five-year warranty.
- C. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: MechoShade; 42-03 35th Street, Long Island City, NY 11101.  
**Local representative: Kathleen Powers: T 480-231-7417**, email: [kathleen.powers@mechoshade.com](mailto:kathleen.powers@mechoshade.com)
- B. Substitutions: Not permitted.

### 2.2 APPLICATIONS/SCOPE

- A. Roller Shade Schedule:
  - 1. Shade Type 1: Manual operating interior, chain drive "double" solar and room darkening blackout roller shades, operating independently of each other, in all exterior windows of rooms and spaces shown on Drawings, and related mounting systems and accessories.

2. Shade Type 2: Motorized interior solar roller shades in all exterior windows of rooms and spaces shown on Drawings, and related motor control systems. Shades with the top of the shade more than 25' AFF or/and bottom of shade is 15'0" above finished floor must have catch pin brackets and guide cables.
3. Shade Type 3: Motorized interior room darkening roller shades with blackout fabric in all exterior windows of rooms and spaces shown on Drawings, and related motor control systems. Shades with the top of the shade more than 25' AFF or/and bottom of shade is 15'0" above finished floor must have catch pin brackets and guide cables.

### **2.3 SHADE CLOTH**

- A. Cleanability and Disinfecting: ShadeCloth must meet cleanability and disinfecting requirements via independent and certified 3<sup>rd</sup> party testing to comply with BIFMA HCF 8.1-2014 standards using chemical solutions compliant with EPA guidelines for use against COVID-19, outlining approved and applicable chemicals and percentage of applicable concentrations by fabric content and type.
  
- B. Visually Transparent Single-Fabric Shadecloth: MechoShade Systems, Inc., ThermoVeil group, single thickness non-raveling 0.030-inch (0.762 mm) thick vinyl fabric, woven from 0.018-inch (0.457 mm) diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colors selected from manufacturer's available range. Solar shadecloth containing fiberglass is not acceptable.
  1. Dense Basket Weave: "1500 series", 3 percent open, 2 by 2 dense basket-weave pattern.
  2. Color: 1519.
  
- C. Vinyl Room Darkening Shadecloth (Single-Fabric): MechoShade's "0700 series", blackout material, washable and colorfast laminated and embossed vinyl coated fabric, 0.012 inches thick (0.30 mm) blackout material and weighing 0.81 lbs. per square yard, with a minimum of 62 threads per square inch in colors selected from manufacturer's available range.
  1. Color: 0701.

### **2.4 SHADE BAND**

- A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
  1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.
  2. Shade band and Shade Roller Attachment:

- a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37 mm) in diameter for manual shades, and less than 2.55 inches (64.77 mm) for motorize shades are not acceptable.
- b. Provide for positive mechanical engagement with drive / brake mechanism.
- c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
- d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
- e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

## 2.5 SHADE FABRICATION

- A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.
- B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:
  - 1. Bottom hem weights.
  - 2. Concealed hemtube.
- C. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.
- D. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.
- E. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.
- F. Blackout shadebands, when used in side channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 3 feet (115 mm) on center extending fully into the side channels. Battens shall be concealed in a integrally-colored fabric to match the inside and outside colors of the shadeband, in accordance with manufacturer's published standards for spacing and requirements.
  - 1. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.

2. Batten pockets shall be self-colored fabric front and back RF welded into the shadecloth. A self-color opaque liner shall be provided front and back to eliminate any see through of the batten pocket that shall not exceed 1-1/2 inches (38.1 mm) high and be totally opaque. A see-through moiré effect, which occurs with multiple layers of transparent fabrics, shall not be acceptable.

## 2.6 COMPONENTS

### A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

### B. Motorized Shade Hardware and Shade Brackets:

1. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade.
2. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).
3. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8-45 degrees from the motor axis between shade bands (4-22.5 degrees) on each side of the radial line, by a single shade motor (multi-banded shade, subject to manufacturer's design criteria).
4. Provide brackets with catch pins for shades with the following mounting conditions: top of shade mounted 25'0" or more above finished floor or/and bottom of shade is 15'0" above finished floor.
  - a. Provide shade hardware constructed of minimum 10GA (0.1345") thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade. Plastic components without use of steel angle construction do not meet the intent of this specification and shall not be accepted.
  - b. Provide minimum rate of withstand loads of 250 Lb to system with two to four pins.

### C. Manual Operated Chain Drive Hardware and Brackets:

1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.

4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
  5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
  6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable
  7. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
  8. Drive Bracket / Brake Assembly:
    - a. MechoShade Drive Bracket model M5 shall be fully integrated with all MechoShade accessories, including, but not limited to: SnapLoc fascia, room darkening side / sill channels, center supports and connectors for multi-banded shades.
    - b. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.525 mm) steel pin.
    - c. The brake shall be an over -running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.
    - d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
    - e. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.
- D. Drive Chain: #10 qualified stainless steel chain rated to 90 lb. (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted.

## **2.7 MOTOR AND MOTOR CONTROL SYSTEMS**

## INTELLIGENT ENCODED SHADE MOTOR DRIVE SYSTEM

- A. Shade Motors:
1. Quiet [44 – 46 db] Intelligent Encoded Motor and Control System: Tubular, asynchronous (non-synchronous) motors, with built-in reversible capacitor operating at 110v AC (60hz), (230v/50 hz AC) single phase, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor.
  2. Conceal motors inside shade roller tube.
  3. Maximum current draw for each shade motor of 2.3 amps @ 110 V (.9 amps @230 V AC).
  4. Use motors rated at the same nominal speed for all shades in the same room.
- B. Total hanging weight of shade band shall not exceed 80 percent of the rated lifting capacity of the shade motor and tube assembly. Spring assisted lift systems shall not be accepted.
- C. Quiet Intelligent Encoded Motor System (software, two-way communication): Specifications and design are based on the Intelligent Motor Control System / WhisperShade-IQ™ Motor System) as manufactured by MechoShade. Other systems may be acceptable providing all of the following performance capabilities are provided. Motor control systems not in complete compliance with these performance criteria shall not be accepted as equal systems.
1. Quiet operation of up to 46dBA within 3' feet, open air.
  2. Upper and lower stopping points (operating limits) of shade bands shall be programmed into motors via a hand held removable program module / configurator.
  3. Intermediate stopping positions for shades shall allow for up to three (3) repeatable and precise aligned positions.
  4. Up to 103 available alignment points including 3-user programmable predefined intermediate positions, for a total of 5-defined and aligned positions. All shades on the same switch circuit with the same opening height shall align at each intermediate stopping position.
  5. Two inherent methods of control:
    - a. Cost effective, low voltage, hardwired dry-contact for local switch or 3<sup>rd</sup> party control operation.
    - b. Expandable to 2-way communication network with IQ/485-NI to support whole building low-voltage control and integration.
  6. Alternate: Mecho-RF™ via Zigby™ wireless mesh, network communication available to reduce low voltage wiring and field labor associated costs.
  7. Uniform or Regular Modes of Operation:
    - a. Uniform mode shall allow for shades to only move to intermediate stop positions.
    - b. Regular mode shall allow for shades to move to both intermediate stop positions, plus any position desired between the upper and lower limits as set by the installer.
  8. Wall Switches:
    - a. IQ-Switch: in 5 or 10 button, single gang, low voltage.

9. Expandable IQ-485-NI: Available when addressability of each motor or group of motors are required to be on a two-way addressable communication network for whole building or overlapping multi-level control. System Features include:
  - a. 5 @ IQ, Local or Master ports
  - b. 1 @ Photocell input for automated control of shades
  - c. 1 @ IR Eye Input for wireless remote control of shades
  - d. Software Addressable IQ Ports support Multi-Level control with 8 addresses per port
  - e. IQ-485 MS Bus, 485 shall allow up to 65000 addresses controlling up to 500,000 motors per network
  - f. Shall allow for variety of switch and other user interface options including RF and Ethernet (IP)
    - g. Shall support 3<sup>rd</sup> party control integration via RS232 and Ethernet (IP)

## 2.8 ACCESSORIES

- A. Fascia:
  1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
  2. Fascia shall be able to be installed across two or more shade bands in one piece.
  3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
  4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
  5. Notching of Fascia for manual chain shall not be acceptable.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 INSTALLATION

- A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow proper clearances for window operation hardware.
- B. Coordinate the following with the roller shade installer/dealer:

1. Main Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
  2. Main Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
  3. Electrician shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer. Electrician shall run low voltage as required.
  4. Roller shade installer/dealer shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/ control locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction.
  5. Main Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.
- C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- D. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- E. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

### **3.4 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION**



**SECTION 12 3600  
COUNTERTOPS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Countertops for architectural cabinet work.
- B. Wall-hung counters and vanity tops.
- C. Sinks molded into countertops.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 4100 - Architectural Wood Casework.
- B. Section 22 4000 - Plumbing Fixtures: Faucets and drains for integral Sinks.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- C. IAPMO Z124 - Plastic Plumbing Fixtures; 2017, with Errata.
- D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

**1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- B. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

**1.07 FIELD CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

## **PART 2 PRODUCTS**

### **2.01 COUNTERTOPS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
  - 1. Laminate Sheet: NEMA LD 3, Grade HGS, for horizontal surfaces,.048 inch nominal thickness.
    - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    - c. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
    - d. Finish: Matte or suede, gloss rating of 5 to 20.
    - e. Surface Color and Pattern: As selected by Architect from the manufacturer's full line.
  - 4. Exposed Edge Treatment: Postformed laminate; front edge substrate built up to minimum 1-1/4 inch (32 mm) thick with raised radiused edge, integral covered backsplash with radiused top edge.
  - 5. Back and End Splashes: Same material, same construction.
- C. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
  - 1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
  - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    - a. Manufacturers:
      - 1) Dupont: [www.corian.com](http://www.corian.com). -Basis of design: See Model and color in interior material schedule.
      - 2) Basis of Design: Formica Corporation; Traditions, Bleached Concrete: [www.formica.com](http://www.formica.com).
      - 3) Wilsonart: [www.wilsonart.com](http://www.wilsonart.com).
      - 4) Substitutions: See Section 01 6000 - Product Requirements.
    - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    - c. Sinks and Bowls: Integral castings; minimum 3/4 inch (19 mm) wall thickness; comply with IAPMO Z124.
    - d. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
    - e. Color and Pattern: As indicated on drawings.
  - 3. Other Components Thickness: 1/2 inch (12 mm), minimum.
  - 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch (32 mm) thick; square edge; use marine edge at sinks.
  - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.
  - 6. Skirts: As indicated on drawings.
  - 7. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Custom Grade.

### **2.02 ACCESSORY MATERIALS**

- A. Fixed Top-Mounted Countertop Support Brackets.
- B. Metal Brackets and Braces.
- C. Stainless Steel Trash Grommets.

## **2.03 FABRICATION**

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  - 1. Join lengths of tops using best method recommended by manufacturer.
  - 2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
  - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
  - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
  - 2. Height: 4 inches (102 mm), unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches (3,657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
- D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces, finished to match.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### **3.03 INSTALLATION**

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).
- C. Seal joint between back/end splashes and vertical surfaces.

### **3.04 TOLERANCES**

- A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.
- B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.
- C. Field Joints: 1/8 inch (3 mm) wide, maximum.

### **3.05 CLEANING**

- A. Clean countertops surfaces thoroughly.

### **3.06 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**SECTION 14 2100**  
**ELECTRIC TRACTION ELEVATORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electric traction elevator systems.
- B. Maintenance Contract.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete.
- B. Section 04 2000 - Unit Masonry.
- C. Section 09 6500 - Resilient Flooring.
- D. Section 21 1300 - Fire-Suppression Sprinkler Systems.
- E. Section 26 0533.13 - Conduit for Electrical Systems: Electrical conduit requirements.
- F. Section 26 0583 - Wiring Connections: Wiring connection requirements.

**1.03 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- D. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- E. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2019, with Errata (2021).
- F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- G. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- I. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- L. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2021).
- N. ITS (DIR) - Directory of Listed Products; current edition.
- O. NEMA MG 1 - Motors and Generators; 2018.
- P. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- Q. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- R. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
- S. UL (DIR) - Online Certifications Directory; Current Edition.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate work with other installers to provide necessary conduits for proper installation of wiring, including but not limited to, the following:
    - a. Elevator equipment devices remote from elevator machine room or hoistway.
    - b. Telephone service for machine room.
    - c. Elevator pit for lighting, sump pump, and \_\_\_\_\_.
    - d. Fire alarm panel from controller cabinet.
  - 2. Coordinate work with other installers for equipment provisions necessary for proper elevator operation, including but not limited to, the following:
    - a. Automatic transfer switches with auxiliary contacts for emergency power transfer status indication.
    - b. Shunt trip devices for automatic disconnection of elevator power prior to fire suppression system activation; include provisions for shunt trip power monitoring.
- B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
  - 1. Review schedule of installation, proper procedures and conditions, and coordination with related work.
  - 2. Review use of elevator for construction purposes, hours of use, scheduling of use, cleanliness of car, employment of operator, and maintenance of system.
- C. Construction Use of Elevator: Not permitted.

#### 1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit data on following items:
  - 1. Signal and operating fixtures, operating panels, and indicators.
  - 2. Car design, dimensions, layout, and components.
  - 3. Car and hoistway door and frame details.
  - 4. Electrical characteristics and connection requirements.
- C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
  - 1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
  - 2. Hoistway Components: Size and location of car machine beams, guide rails, buffers, ropes, and other components.
  - 3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
  - 4. Clearances and over-travel of car and counterweight.
  - 5. Locations in hoistway and machine room of traveling cables and connections for car lighting, telephone, and any other required equipment.
  - 6. Location and sizes of hoistway and car doors and frames.
  - 7. Applicable seismic design data; certified by a licensed Professional Structural Engineer.
  - 8. Electrical characteristics and connection requirements.
  - 9. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.
- D. Samples: Submit samples illustrating car floor material, car interior finishes, car and hoistway door and frame finishes, handrail material and finish, and \_\_\_\_\_ in the form of cut sheets, finish color selection brochures, or samples as required.
- E. Testing Agency's Qualification Statement.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- G. Initial Maintenance Contract.

- H. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
  - 1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.
- I. Operation and Maintenance Data:
  - 1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
  - 2. Operation and maintenance manual.
  - 3. Schematic drawings of equipment, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.

## 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Installer Qualifications: Supervisor along with trained elevator installation personnel on staff of elevator equipment manufacturer.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.
- D. Products Requiring Fire Resistance Rating: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
- E. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to authorities having jurisdiction as suitable for the purpose indicated in construction documents.

## 1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Electric Traction Elevators: BASIS OF DESIGN; OTIS ELEVATORS; Gen3 Edge 2500# & 3500# - 150 F.P.M.
- B. Other Acceptable Manufacturers
  - 1. KONE: [www.kone.us/#sle](http://www.kone.us/#sle).
  - 2. ThyssenKrupp Elevator; \_\_\_\_\_: [www.thyssenkruppelevator.com/#sle](http://www.thyssenkruppelevator.com/#sle).
- C. Substitutions: See Section 01 6000 - Product Requirements.
- D. Products other than Basis of Design are subject to compliance with specified requirements and prior approval of Architect. By using products other than Basis of Design, the Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

### 2.02 ELECTRIC TRACTION ELEVATORS

- A. Electric Traction Passenger Elevator: BASSIS OF DESIGN; OTIS ELEVATORS; Gen3 Edge 2500# & 3500# - 150 F.P.M.
  - 1. Service Control Type:
    - a. Standard service control only.
  - 2. Interior Car Height: 93 inch.
  - 3. Electrical Power: Per Manf. Requirements, Coordinate with electrical drawings. ; \_\_\_\_\_ Hz
  - 4. Rated Net Capacity: 2500 pounds & 3500 pounds

5. Rated Speed: 125 to 150 feet per minute.
6. Hoistway Size: As indicated on drawings.
7. Interior Car Platform Size: As indicated on drawings.
8. Elevator Pit Depth: 48 inch.
9. Overhead Clearance at Top Floor: Manufacturers required number of inches
10. Travel Distance: As indicated on drawings.
11. Number of Stops: As indicated on drawings.
12. Number of Openings: 1 Front
13. Traction Machine Location: Top of hoistway shaft.

### **2.03 COMPONENTS**

- A. Elevator Equipment:
  1. Motors, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70 requirements, and see Section 26 0583 for additional information.
  2. Guide Rails, Cables, Counterweights, Sheaves, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
  3. Buffers: Per Manf.
  4. Sump Pump:
    - a. If required by code / AHJ shall be included with this submittal. Coordinate with foundation / pit installation as required. Coordinate with electrical for wiring as required.
- B. Electrical Equipment:
  1. Motors: NEMA MG 1.
  2. Boxes, Conduit, Wiring, and Devices: Comply with NFPA 70 requirements, and see Sections 26 0533.13 and 26 0583 for additional information.
  3. If sump pump is required, coordinate requirements with electrical contractor.
  4. Include wiring and connections to elevator devices remote from hoistway and between elevator machine room. Provide additional components and wiring to suit machine room layout. See Section 26 0583.

### **2.04 PERFORMANCE REQUIREMENTS**

- A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
- B. Accessibility Requirements: Comply with ADA Standards.
- C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.
- D. Perform welding of steel in accordance with AWS D1.1/D1.1M.
- E. Fabricate and install door and frame assemblies in accordance with NFPA 80 and complying with requirements of authorities having jurisdiction (AHJ).
- F. Perform electrical work in accordance with NFPA 70.
- G. Comply with venting or pressurization of hoistway design in accordance with HVAC system requirements and authorities having jurisdiction (AHJ).
- H. Comply with fire protection sprinkler system of hoistway design in accordance with NFPA 13 requirements and authorities having jurisdiction (AHJ). See Section 21 1300.

### **2.05 OPERATION CONTROLS**

- A. Elevator Controls: Provide landing operating panels, landing indicator panels, and \_\_\_\_\_.
  1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
  2. Landing Indicator Panels: Illuminating.
  3. Comply with ADA Standards for elevator controls.
- B. Interconnect elevator control system with building security, fire alarm, card access, smoke alarm, building management control, and \_\_\_\_\_ systems.

- C. Door Operation Controls:
  1. Program door control to open doors automatically when car arrives at floor landing.
  2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
  3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.
- D. Lobby Monitoring Panel:
  1. Locate status indicator and control panel for each individual elevator and group of elevators as indicated on drawings.
  2. Etch face plate markings in panel, and fill with paint of contrasting color.
  3. Include direction indicator displaying landing "Up" and "Down" calls registered at each landing floor.
  4. Include position and motion display for direction of travel of each elevator; display appropriate graphic characters on non-glare screen; indicate position of cars at rest and in motion.
  5. Include "Firefighter's Service Switch" that manually recalls each elevator to main floor.
- E. Provide "Firefighter's Emergency Operation" in accordance with ASME A17.1, applicable building codes, authorities having jurisdiction (AHJ), and \_\_\_\_\_.
  1. Designated Landing: Main Lobby on 1st floor.

## 2.06 OPERATION CONTROL TYPE

- A. Two-Car Selective Collective Automatic (Duplex Collective Automatic) Operation Control: Applies to cars in two elevator shafts.
  1. Park one car at main floor and designate other as free car, at landing last served or at a predetermined upper floor landing.
  2. Arrange free car to answer landing calls either above or below landing where car is standing except main floor and basement landing calls.
  3. When free car is answering calls, automatically start an alternate car to answer landing calls under any of the following conditions:
    - a. Registration of up calls from landings below the free car while it is traveling up by alternate car below.
    - b. Registration of up or down calls from landings above the free car while it is traveling down by alternate car.
    - c. Free car fails to clear registered landing calls within 40 seconds, or to move alternate car in response to registered landing calls within this time frame.
  4. Register and answer calls by momentary pressure on one or more car buttons; cause car to respond.
  5. Once started, either in response to car button calls, or to landing button calls, respond to calls registered for the direction of the traveling car in the order that landings are reached, regardless of sequence that calls were registered.
  6. Allow only one car to stop in response to any one landing call.
  7. Return first free car to main floor after answering landing calls.
  8. Should both cars finish their calls at main floor, designate one car as the free car.
  9. If no car buttons are pressed and car starts up in response to several landing down calls, proceed first to the highest landing down call, then reverse to collect other landing down calls. Collect up calls similarly when car starts down in response to such calls.
  10. If a car stops for a landing call, and car button matching direction the car was traveling is pressed within a predetermined time interval after a landing stop, proceed in the same direction regardless of other landing calls that are registered.
  11. If down landing buttons are pressed while car is traveling up, do not stop at those landings but allow those calls to remain registered for answering by the next down traveling car.
  12. After the highest car has responded to up landing calls, reverse car automatically and respond to down landing calls.



13. When traveling down, a car will not respond to up calls. Allow those up calls to remain registered to be answered by next available car on an up trip.
14. Include a time delay to hold car for an adjustable time interval at landings where stops are made to enable passengers to enter or leave the car. Cancel the time interval upon registration of a car call or pressure on the car door close button.
15. Permit a registered car call to establish the direction of travel when a car has answered the farthest car call, even if other landing calls are registered.
16. Answer calls to the basement landing with the car that is normally parked at the main floor unless the free car is at the basement.
17. If a car is removed from service, the other car shall answer landing calls.

## **2.07 SERVICE CONTROL TYPE**

- A. Restricted Access Service Control:
  1. Landing Call Lock-out: Provide a key operated switch with key removable from "On" or "Off" position in landing control station that performs the following when activated:
    - a. Restricts or permits landing call registration for that landing.
    - b. Causes the elevator to not respond to that landing.
  2. Allow "Firefighter's Emergency Operation" to take control priority over "Restricted Access Service Control".

## **2.08 MATERIALS**

- A. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.
- B. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- C. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish unless otherwise indicated.
- D. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.
- E. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.
- F. Tempered Glass: 3/8 inch minimum thickness, fully tempered in compliance with ASME A17.1, 16 CFR 1201, ANSI Z97.1, and ASTM C1048 tempered glass requirements.
- G. Resilient Flooring: Vinyl tile flooring and Resilient base, see Section 09 6500.

## **2.09 CAR AND HOISTWAY ENTRANCES**

- A. Elevator, No. 1:
  1. Car and Hoistway Entrances, Main Elevator Lobby:
    - a. Hoistway Fire Rating: 2 Hours.
    - b. Elevator Door Fire Rating: 1-1/2 Hours.
    - c. Framed Opening Finish and Material: Brushed stainless steel.
    - d. Car Door Material: Stainless steel, with rigid sandwich panel construction.
    - e. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.
    - f. Door Width: 36 inch.
    - g. Door Height: 84 inch.
- B. Elevator, No. 2:
  1. Car and Hoistway Entrances, Main Elevator Lobby:
    - a. Hoistway Fire Rating: 2 Hours.
    - b. Elevator Door Fire Rating: 1-1/2 Hours.
    - c. Framed Opening Finish and Material: Brushed stainless steel.
    - d. Car Door Material: Stainless steel, with rigid sandwich panel construction.
    - e. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.
    - f. Door Width: 36 inch.
    - g. Door Height: 84 inch.

## **2.10 CAR EQUIPMENT AND MATERIALS**

- A. Elevator Car, No. 1:

1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons, "Door Open" button, "Door Close" button, and alarm button.
  - a. Panel Material: Integral with front return; one per car.
  - b. Car Floor Position Indicator: Above door with illuminating position indicators.
  - c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
2. Flooring: Resilient vinyl tile.
3. Wall Base: Recessed stainless steel, 4 inch high.
4. Front Return Panel: Match material of car door.
5. Door Wall: Stainless steel.
6. Hand Rail: Aluminum, at three side walls. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
  - a. Aluminum Finish: Clear anodized.
7. Ceiling:
  - a. Canopy Ceiling: Stainless steel.
  - b. Frame Finish: Color anodized aluminum.
- B. Car Accessories:
  1. Certificate Frame: Stainless steel frame glazed with clear tempered glass, and attached with tamper-proof screws.

## **2.11 FINISHES**

- A. Clear Anodized Finish: Class I, AAMA 611 AA-M12C22A41 Clear anodic coating with electrolytically deposited organic seal; not less than 0.7 mils, 0.0007 inch thick.
- B. Color Anodized Finish: Class I, AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils, 0.0007 inch thick.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting this work.
- B. Verify that hoistway, pit, and machine room are ready for work of this section.
- C. Verify hoistway shaft and openings are of correct size and within tolerance.
- D. Verify location and size of machine foundation and position of machine foundation bolts.
- E. Verify that electrical power is available and of correct characteristics.

### **3.02 PREPARATION**

- A. Arrange for temporary electrical power for installation work and testing of elevator components. See Section 01 5000 - Temporary Facilities and Controls for additional requirements.
- B. Maintain elevator pit excavation free of water.

### **3.03 INSTALLATION**

- A. Coordinate this work with installation of hoistway wall construction.
- B. Install system components, and connect equipment to building utilities.
- C. Provide conduit, electrical boxes, wiring, and accessories; see Sections 26 0533.13 and 26 0583.
- D. Mount machines, motors, and pumps on vibration and acoustic isolators.
  1. Place on structural supports and bearing plates.
  2. Securely fasten to building supports.
  3. Prevent lateral displacement.
- E. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.
- F. Install guide rails to allow for expansion and contraction movement of guide rails.

- G. Accurately machine and align guide rails, forming smooth joints with machined splice plates.
- H. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.
- I. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime with two coats.
- J. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.
- K. Adjust equipment for smooth and quiet operation.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Testing and inspection by regulatory agencies certified in accordance with ASME QEI-1 will be performed at their discretion.
- C. Operational Tests:
  - 1. Perform operational tests in the presence of Owner and Architect.
  - 2. At an agreed time, and the building occupied with normal building traffic, conduct tests to verify performance.
    - a. Furnish event recording of each landing call registrations, time initiated, and response time throughout entire working day.
  - 3. Set period of time elevator takes to travel between typical floor landings at not more than \_\_\_\_\_ seconds.
    - a. Measure time from moment doors start to close until car has stopped level at next floor landing and doors are opening.

### **3.05 ADJUSTING**

- A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.
- B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

### **3.06 CLEANING**

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Remove protective coverings from finished surfaces.
- C. Clean surfaces and components in accordance with manufacturers written instructions.

### **3.07 CLOSEOUT ACTIVITIES**

- A. Demonstrate proper operation of equipment to Owner's designated representative.
- B. Training: Train Owner's personnel on cleaning and operation and maintenance of system.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Location: At project site, unless otherwise indicated.

### **3.08 PROTECTION**

- A. Do not permit construction traffic within car after cleaning.
- B. Protect installed products until Date of Substantial Completion.
- C. Touch-up, repair, or replace damaged products and materials before Date of Substantial Completion.

### **3.09 MAINTENANCE**

- A. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for three months from Date of Substantial Completion.
- B. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or installer.

- C. Include systematic examination, adjustment, and lubrication of elevator equipment.
- D. Perform work without removing cars from use during peak traffic periods.

**END OF SECTION**

**SECTION 14 9182  
LAUNDRY AND LINEN CHUTES**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS**

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

**B. RELATED SECTIONS**

1. Division 21 0000 Sections for connection to Sprinklers.
2. Division 22 0000 Sections for connecting the Disinfecting and Sanitizing Unit.
3. Division 26 0000 Sections for electrical connects to Electric Interlocks.
4. Division 28 0000 Sections for Smoke Detectors.

**C. DESCRIPTION OF WORK**

1. This section includes Trash Chutes.

**1.2 SUBMITTALS**

A. See Section 01 7700 – Administrative Requirements, for submittal procedures. General Contractor to furnish Subcontractor approved shop drawings and plan view drawing of trash room.

1. Product Data: Manufacturer's product specifications, standard details and recommendations for project conditions; indicate selected sizes and installation details specific to the project.
2. Shop Drawings:
  - a. Specific project conditions
  - b. Dimensions and clearances required
  - c. Products required for installation of the chute, but not supplied by manufacturer.

Close-out Submittals:

3. Operation and Maintenance Manual (O&M Manual).
4. Warranty Documents: Issued and executed by the manufacturer and installer of the system.

**1.3 QUALITY ASSURANCE**

A. Qualifications:

1. Manufacturer: Minimum ten (10) years documented experience-producing products specified in this section.
2. Installer: Approved by the Manufacturer, and/or having a minimum of five (5) years experience.
3. Products must be manufactured in the United States.

B. Fire Rated Door Assemblies: UL Labeled Intake doors and Access doors: Minimum 1½-hour fire rated with 30-minute temperature rise of 250° F (140° C) Maximum.

C. Standard: Provide chutes complying with NFPA 82.

**1.4 WARRANTY**

A. Manufacturer's warranty: Furnish manufacturer's standard one (1) year warranty from date of installation. Warranty shall apply to defects in product workmanship and material only.

**1.5 RELATED WORK BY OTHERS SPECIFIED ELSEWHERE**

A. The following work is excluded from the scope of work in this Section 14 9100 and is included in other divisions of the specifications for inclusion in the scope of work for others.

1. Electrical Standards: The following electrical circuits with disconnects are required and are to be installed by others: 1 each: 120VAC, 20 Amp 1-Phase, 60 Hz Circuit. Local disconnect box to be NEMA 13

2. Installation of sprinkler heads provided w/chute.
3. Water supply and valves to fire sprinkler heads and flushing spray heads.
4. ADA- Braille signage provided by others, if required.

## **PART 2 – PRODUCTS**

### **2.1 MANUFACTURER**

#### **A. Basis of Design:**

1. **CHUTES International Manufacturing**,  
33 Industrial Park Drive, Waldorf, Maryland 20602;  
Telephone: (800) 882-4883; FAX (301) 753-4109.  
[www.chutes.com](http://www.chutes.com) or [info@chutes.com](mailto:info@chutes.com)

### **2.2 TRASH CHUTES**

#### **A. Chute Metal: [Aluminum-coated; ASTM A 463/A 463M, Type 1 with not less than T1-40 (T1M-120)coating] [430 ROF Stainless Steel; ASTM A240/ASME SA240] [304 Stainless Steel; ASTM A 240] cold-rolled, commercial steel sheet.**

1. Thickness: **0.060 inch (16 gauge)**.
- B. Size: 24 inch diameter.**
- C. Fire Sprinklers:** Manufacturer's standard NPS ½" (DN 13) fire sprinklers ready for piping connections. Furnished only, Installed by others.

### **2.3 DOORS**

- A. Intake Door Assemblies:** Stainless steel front and back, noiseless, self-closing with positive latch and ADA compliant lever handle; as required to provide fire-protection and temperature rise ratings indicated. And with corrosion-resistant, industrial grade enamel painted steel frame suitable for enclosing chase construction.
1. Door type: Bottom hinged, hopper type, typically used in public access applications.
  2. Stainless Steel intake trash deflector to protect bottom of intake door from debris build-up.
  3. Size: Manufacturer's standard size for door type, chute type, and diameter indicated.
  4. Finish: Stainless steel, front and back, with No. 3 finish.
  5. Handles and Locks: ADA compliant lever handle, cylinder locks with 2 keys. All locks keyed alike.
  6. Electric Interlocks: Interlock system that is energized by opening one intake door. All other doors remain locked when system is energized. Control System: Manual control system with key operated switch that locks doors of chute during shut-down hours and/or service operations, including manual override switch to bypass interlock system.
  7. ADA Compliant bottom-hinged, self-closing, positive latching, pneumatically operated chute intake doors with push button opening mechanism designed to preclude the need to grasp, twist or pinch the control mechanism in order to operate the intake doors.
  8. The Pneumatic Intake Door opens to the FULL-OPEN position and remains open typically for 10 seconds or any other time selected. Door then closes automatically releasing the pneumatic interlock valve. Air Regulator/Dump Valve Control System: Control system with air regulator and manual dump valve to de-energize chute intake doors during shut-down hours and/or service operations, including manual override switch to bypass interlock system
  9. Pneumatic Interlocks: Interlock system that is energized by opening one intake door; interlock valve shuts off air pressure to the remaining doors automatically locking them out until the door in use closes.

- B. Discharge Assemblies: Required to provide fire protection; equipped with fusible links that cause discharge to automatically close in the event of a fire.
  - 1. Direct Vertical Discharge:
    - A. "Accordion Damper Assembly", "UL" labeled, interlocking type blades held open by fusible link assembly for automatic closing with heat rising above 165° F.

## 2.4 OPTIONAL ACCESSORIES

- A. Heat and Smoke Detector connection: Electro Thermal Fusible Link and wire connection at Manual Control Box to lock out chute doors. *NOTE: Only available with electric & pneumatic interlock systems.* (Heat Sensor located outside discharge door). 24-32 VDC contact Smoke Detector supplied by others, manufacturer provides connection only.
- B. Access Door Assembly: Stainless steel front and back, noiseless, self-closing with positive latch and ADA compliant lever handle; as required to provide fire-protection and temperature rise ratings indicated. And with corrosion-resistant, industrial grade enamel painted steel frame suitable for enclosing chase construction; and in No. 3 finish.
- C. Disinfecting and Sanitizing Unit: NPS ¾" (DN 19) disinfecting and sanitizing spray head unit located in chute above highest intake door, including 1-gal. (3.8-L) tank and adjustable proportioning valve with bypass for manual control of sanitizing and flushing operation, ready for hot or cold water piping connection, and with access for head and piping maintenance.

## 2.5 CHUTE FABRICATION

- A. The trash chute sections shall be factory assembled and all vertical seams shall be fully welded. All sections shall sleeve inside the sections below and there shall be no bolts, clips, or other projections inside the chute to snag the flow of material. Pre-positioned support clips shall assure proper intake levels and there shall be an expansion joint in the chute between all support joints. Discharge offsets, where required, shall be made with 12 gauge material at area of impact. No 'spiral' manufactured sections within chute will be allowed.
- B. Vent: Full diameter Aluminum .080 (12 gauge) vent extending 3 feet (per NFPA Code 82; 2009) above roof penetration with aluminum hinged metal safety cap.
- C. Standard Floor Frames: Corrosion resistant, industrial grade enamel painted, steel angle floor frames, are 1-1/2" x 1-1/2" x 3/16".
- D. Fire Sprinklers: ½" NPT sprinkler and ¾" NPT flushing head at top intake. Additional ½" sprinkler heads at alternate intake floors and at intake above discharge floor as required by NFPA Code 82.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Verification of conditions:
  - 1. Confirm slab penetrations are properly sized (diameter of chute + 4"), aligned, plumb and clear of any obstructions at chute location. Also, confirm floor heights and other applicable dimensions are in accordance with the approved shop drawings.

### 3.2 INSTALLATION

- A. Install chute in accordance with approved shop drawings and manufacturer's printed installation instructions.
- B. General Contractor shall provide control line for location and finished face wall to determine chute intake centerline location.

**END OF SECTION**

**SECTION 21 1313**  
**WET-PIPE SPRINKLER/ STANDPIPE SYSTEMS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Pipes, fittings, and specialties.
  - 2. Fire-protection valves.
  - 3. Fire-department connections.
  - 4. Sprinklers.
  - 5. Standpipes.
  - 6. Alarm devices.
  - 7. Pressure gages.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Delegated Design: Design sprinkler system(s), approved by a qualified professional engineer or NICET Level III or IV technician (as required by the Authority Having Jurisdiction), using performance requirements and design criteria indicated. It will be the Contractor's responsibility to size, design, and install a complete fire protection system on a design build basis to comply with direction of Engineer as shown on the contract drawings and all codes and applicable standards for the proposed building and available utilities. No change orders will be issued due to the Contractor's failure to fully investigate all requirements of the system and system components required for a fully operational system in accordance with all applicable codes.
- C. Sprinkler system design shall be approved by Authorities Having Jurisdiction.
  - 1. Preliminary civil calculation. The results of the water flow test were as follows:
    - a. Water flow is from a 6" new underground city main to hotel. Fire pump in hotel will feed new 4" fire line from hotel to restaurant. Hotel to be equipped with standpipe system to produce 750 gpm @ 100 psi at topmost remote outlets.
  - 2. Sprinkler Occupancy Hazard Classifications:
    - Restaurant: Design and Install new wet pipe fire sprinkler systems to accommodate an A-2 occupancy. System shall be designed for light hazard occupancy 0.10 gpm psf / 1500 sqft. and ordinary hazard group I occupancy 0.15 gpm psf/ 1500 sqft. Area reductions as allowed by NFPA13 are acceptable.
    - Hotel: System shall be designed for residential occupancy per NFPA 13R.
    - Kitchen: Ordinary Hazard, Group I
    - Electrical Equipment Rooms: Ordinary Hazard, Group I
    - Mechanical Equipment Rooms: Ordinary Hazard, Group I
    - Work Rooms: Ordinary Hazard, Group I
  - 3. Maximum Protection Area allowed for Extended Coverage Sprinkler 400 sq. ft/ head and 225 sqft for standard coverage sprinklers
  - 4. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
    - Light hazard system: 100 gpm
    - Ordinary hazard system: 250 gpm

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer or NICET Level III or IV responsible for their preparation.



- D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by Authorities Having Jurisdiction, including hydraulic calculations
- E. Welding certificates.
- F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- G. Field quality-control reports.
- H. Operation and maintenance data.

#### **1.04 QUALITY ASSURANCE**

- A. Installer Qualifications:
  - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing.
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 and NFPA 72, by a qualified testing agency, and marked for intended location and application.
- D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13, "Installation of Sprinkler Systems.", 2016 edition.
  - 2. NFPA 20, "Standard for the Installation of Standpipe and Hose Systems.", 2016 edition.

### **PART 2 PRODUCTS**

#### **2.01 STEEL PIPE AND FITTINGS**

- A. Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M, ASTM 795. Pipe ends may be factory or field formed to match approved joining method.
- B. Schedule 30, Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match approved joining method.
- C. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- D. Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. Cast-Iron Flanges: ASME 16.1, Class 125.
- G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- H. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Pressure Rating: 175 psig minimum.
  - 2. Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
  - 3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

#### **2.02 LISTED FIRE-PROTECTION VALVES**

- A. General Requirements:
  - 1. Valves shall be UL listed or FM approved.
  - 2. Minimum Pressure Rating: 175 psig.
- B. Check Valves:
  - 1. Standard: UL 312.
  - 2. Pressure Rating: 250 psig minimum
  - 3. Type: Swing check.

4. Body Material: Cast iron.
  5. End Connections: Flanged or grooved.
- C. Iron OS&Y Gate Valves:
1. Standard: UL 262.
  2. Pressure Rating: 250 psig minimum
  3. Body Material: Cast or ductile iron.
  4. End Connections: Flanged or grooved.
- D. Indicating-Type Butterfly Valves:
1. Standard: UL 1091.
  2. Pressure Rating: 175 psig minimum.
  3. Valves NPS 2 (DN 50) and Smaller:  
Valve Type: Ball or butterfly.  
Body Material: Bronze.  
End Connections: Threaded.
  4. Valves NPS 2-1/2 (DN 65) and Larger:  
Valve Type: Butterfly.  
Body Material: Cast or ductile iron.  
End Connections: Flanged, grooved, or wafer.
  5. Valve Operation: All control valves to have tamper switches for wiring to the FACP by others. Test header control valve to have NC tamper switches for wiring by others.
- E. Hose Valves:
1. Standard: UL 668.
  2. Pressure Rating: 300 psig minimum
  3. Body Material: Brass ASTM B584.
  4. End Connection: Threaded, matching local fire-department sizes and threads.

### **2.03 TRIM AND DRAIN VALVES**

- A. General Requirements:
1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  2. Minimum Pressure Rating: 175 psig.

### **2.04 SPECIALTY VALVES**

- A. General Requirements:
1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  2. Minimum Pressure Rating: 175 psig.
  3. Body Material: Cast or ductile iron.
  4. Size: Same as connected piping.
  5. End Connections: Flanged or grooved.
- B. Automatic (Ball Drip) Drain Valves:
1. Standard: UL 1726.
  2. Pressure Rating: 175 psig minimum.
  3. Type: Automatic draining, ball check.
  4. Size: NPS 3/4 (DN 20).
  5. End Connections: Threaded.

### **2.05 FIRE-DEPARTMENT CONNECTIONS**

- A. Siamese Y-Type, Fire-Department Connection:
1. Standard: UL 405.
  2. Type: Flush, for wall mounting.
  3. Pressure Rating: 175 psig minimum.
  4. Body Material: Corrosion-resistant metal.

5. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
6. Caps: Brass, lugged type, with gasket and chain.
7. Escutcheon Plate: Rectangular, brass, wall type.
8. Outlet: With pipe threads.
9. Body Style: Horizontal
10. Number of Inlets: Two 2.5" NSH Thread
11. Escutcheon Plate Marking: AUTO SPKR
12. Finish: Polished chrome plated

## **2.06 SPRINKLER SPECIALTY PIPE FITTINGS**

- A. Flow Detection and Test Assemblies:
  1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  2. Pressure Rating: 175 psig minimum
  3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
  4. Size: Same as connected piping.
  5. Inlet and Outlet: Threaded.
- B. Sprinkler Inspector's Test Fittings:
  1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  2. Pressure Rating: 175 psig minimum
  3. Body Material: Cast- or ductile-iron housing with sight glass.
  4. Size: Same as connected piping.
  5. Inlet and Outlet: Threaded.

## **2.07 SPRINKLERS**

- A. General Requirements:
  1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
- B. Sprinkler Finishes:
  1. White or Chrome for pendants.
  2. Bronze for uprights.
- C. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed and recessed-type sprinklers are specified with sprinklers. Do not use 401 escutcheons unless required for specific application.
  1. Ceiling Mounting: White or chrome, two piece
  2. Sidewall Mounting: White or chrome, two piece.
- D. Sprinkler Guards:
  1. General: Install where heads are subject to damage.
  2. Standard: UL 199.
  3. Type: Wire cage with fastening device for attaching to sprinkler.

## **2.08 ALARM DEVICES**

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Flow Indicators:
  1. Standard: UL 346.
  2. Water-Flow Detector: Electrically supervised.
  3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-

adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

4. Type: Paddle operated.
  5. Pressure Rating: 250 psig.
  6. Design Installation: Horizontal or vertical.
- C. Valve Supervisory Switches:
1. Standard: UL 346.
  2. Type: Electrically supervised.
  3. Components: Single-pole, double-throw switch with normally closed contacts.
  4. Design: Signals that controlled valve is in other than fully open position.

## **2.9 PRESSURE GAGES**

- A. Standard: UL 393.
- B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- C. Pressure Gage Range: 0 to 250 psig minimum
- D. Water System Piping Gage: Include "WATER" label on dial face.

## **2.10 ESCUTCHEONS**

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One-Piece, Cast-Brass Escutcheons: rough-brass finish with set-screws.
- C. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with spring clips.
- E. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- F. Split-Casting Floor Plates: Cast brass with concealed hinge.

## **2.11 SLEEVES**

- A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  1. Underdeck Clamp: Clamping ring with set-screws.

## **2.12 SLEEVE SEALS**

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  2. Pressure Plates: Carbon steel
  3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

## **PART 3 EXECUTION**

### **3.01 SERVICE-ENTRANCE PIPING**

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with any requirements for exterior piping in Division 33.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping

- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

### **3.02 PIPING INSTALLATION**

- A. Locations and Arrangements:
  - 1. Deviations from approved working plans for piping require written approval from Engineer.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- I. Wet pipe sprinkler system shall have an air purge valve.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- L. Install sprinklers in all areas and under any obstructions requiring sprinklers for a complete, approved system.
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- N. Provide pipe venting in accordance with NFPA 13 requirements for wet systems.
- O. Fill sprinkler system piping with water.

### **3.03 JOINT CONSTRUCTION**

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. 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.

- H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- I. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- J. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- K. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- L. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- M. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### **3.04 VALVE AND SPECIALTIES INSTALLATION**

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and Authorities Having Jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

### **3.05 SPRINKLER INSTALLATION**

- A. Use dry type heads for any cooler or freezers.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

### **3.06 FIRE-DEPARTMENT CONNECTION INSTALLATION**

- A. Install wall-type, fire-department connections.
- B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

### **3.07 SLEEVE INSTALLATION**

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated or required by applicable Code.
- K. Install sleeve materials according to the following applications:
  1. Sleeves for Piping Passing through Concrete Floor Slabs: Galvanized-steel pipe

2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe  
Extend sleeves 2 inches (50 mm) above finished floor level.  
For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing and Trim."
  3. Sleeves for Piping Passing through Gypsum-Board Partitions:
  4. Galvanized-steel-sheet sleeves for pipes NPS 1 (DN 150) and larger.
  5. Sleeves for Piping Passing through Exterior Concrete Walls:  
Galvanized-steel-pipe sleeves for pipes smaller than NPS 10 (DN 150).
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestop materials and installations in Division 07 Section "Penetration Firestopping."

### **3.08 SLEEVE SEAL INSTALLATION**

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### **3.09 IDENTIFICATION**

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

### **3.10 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. Leak Test: After installation, charge systems 200 psi for 2 hours and test for leaks. Repair leaks and retest until no leaks exist.
  2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  4. Energize circuits to electrical equipment and devices.
  5. Coordinate with fire-alarm tests. Operate as required.
  6. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### **3.11 CLEANING**

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

**END OF SECTION**

## SECTION 21 3113

### ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMP AND FIRE PUMP CONTROLLER

#### PART 1 - GENERAL

##### 1.01 RELATED DOCUMENTS

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

##### 1.02 SUMMARY

- A. Section Includes:
  - 1. End-suction, In-line, Split-case, and Vertical Turbine fire pumps.
  - 2. Fire-pump accessories and specialties.
  - 3. Fire Pump Controllers
  - 4. Pressure maintenance pump controllers
- B. Related Sections:
  - 1. Division 1 Section "Submittal Procedures"
  - 2. Division 9, Section "Painting"
  - 3. Division 21 Section "Wet Pipe Sprinkler Systems" for wet pipe sprinkler piping
  - 4. Division 28, Section "Digital Addressable Fire Alarm Systems"

##### 1.03 DESCRIPTION OF WORK

- A. Scope. Provide an electric drive, centrifugal fire pump, fire pump controller and associated equipment ready for operation.
- B. Description of Work: The work includes the installation of a new electric drive, vertical inline fire pump, fire pump controller and associated equipment in fire pump/sprinkler riser room. Coordinate work with Division 21.

##### 1.04 PERFORMANCE REQUIREMENTS

- A. Water Supply Information
  - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
    - a. TEST DATE: 04/20/2023
    - b. START TIME: 3:00 pm
    - c. TWO FLOW HYDRANTS:
      - 1) STATIC PRESSURE – 89 psi
      - 2) RESIDUAL PRESSURE – 40 psi
    - d. TOTAL FLOW = 841 gpm
    - e. OUTLET COEFFICIENT 0.90
- B. A new 6" water main will be used as the water supply. Performance: Fire pumps shall withstand the effects of earthquake motions determined according to the building code.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces and the unit will be fully operational after the seismic event."
- C. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig (1200 kPa) minimum unless higher pressure rating is indicated.



- D. Pumps shall not be sized based on providing only the building's hydraulically most demanding sprinkler flow. Standpipe flow shall be used for the determining the fire pump sizing.
- E. Pump Bypass: Provide piping and valves as required to bypass the fire pump with city water pressure.
- F. Pressure Reducing Valves shall not be installed in fire pump suction or discharge piping.
- G. Fire Pump Controllers: All fire pump controllers shall be provided with an integral transfer switch, regardless of whether emergency power is available at the time of the installation.
  - 1. Limited Service Controllers shall not be used.

#### 1.05 SUBMITTALS

- A. Submittals to be in accordance with Division 1, Submittal Procedures unless otherwise indicated by this section.
- B. Product Data: Submit a digital set of submittals to the Owner for each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories. Partial submittals will not be acceptable and will be returned without review. Before any work is commenced, the submittal must be approved by the Fire Protection Engineer & AHJ. Manufacturer's data shall be provided for all products listed in Part 2 of this specification and annotated to show the specific model, type and size of each item: Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
- C. Shop Drawings: Submit a digital set detailed shop drawings to the Owner, in accordance with NFPA 13, "Working Plans", on uniform size sheets no smaller than 30 inches by 42 inches to the Fire Protection Engineer for review and approval. Information shall include but not be limited to the following:
  - 1. Detailed plan view, elevation view and isometric diagram of the pump room showing the location of fire pump, pressure maintenance pump, controller, piping, test manifold, pressure sensing lines and all other associated equipment.
  - 2. Complete piping schematic, including pumps, devices, valves and fittings.
  - 3. Complete point to point electrical wiring and circuit diagrams.
  - 4. Interior wiring diagrams of each controller.
  - 5. [Provide a set of CAD based electronic shop drawings to the Owner; each set shall include DWG and DWF file formats, including all associated externally referenced electronic files (Xref's). These files shall contain externally referenced files that have been inserted (do not bind the Xref's). In addition, provide in each set a read only PDF copy of each As-Built drawing for archiving purposes. PDF files shall be created using the PDF Creator utility.]
- D. Hydraulic Calculations: Submit in accordance with Division 21 1313.
- E. Verification of Qualification. Prior to installation, submit documentation, to the Owner, showing that the Contractor has successfully installed electric driven centrifugal fire pump systems of comparable size, type and design as specified herein or that the Contractor has a firm contractual agreement with a Subcontractor having such experience.
  - 1. The data shall include the names and locations of at least three installations where the Contractor, or Subcontractor, installed such systems.
  - 2. The Contractor, or Subcontractor, shall certify that each system has performed satisfactorily for a period of not less than one year.
  - 3. The Contractor or Subcontract shall submit the NICET/PE certification/license number and expiration date.
- F. As Built Drawings:

1. General: Prepare and submit to the Owner a digital set of detailed "As-Built Drawings". The drawings shall show the system as installed, including all deviations from both the project drawings and the approved shop drawings. The drawings shall also include all information as required by NFPA 13. The drawings shall be prepared on uniform sized sheets not less than 30 in by 42 in (760 by 1070 mm). Submit these drawings within two weeks after the final acceptance test of the system.
  2. [Provide a set of CAD based electronic as-built drawings to the Owner; each set shall include DWG and DWF file formats, including all associated externally referenced electronic files (Xref's). These files shall contain externally referenced files that have been inserted (do not bind the Xref's). In addition, provide in each set a read only PDF copy of each As-Built drawing for archiving purposes.
- G. Field Test Reports and Certificates: Submit test certification, to the Owner, for all pipe and fittings. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 20.
- H. Operation and Maintenance Manuals: Not less than [30] calendar days prior to the final acceptance testing of the entire system, and for use during the instruction period hereinafter specified, provide six (6) bound copies of an Operation and Maintenance Manual to the Owner. The manual shall include an index, copies of all approved shop drawings and submittal materials (updated to as-built), and a complete parts list of all components. The manual shall also include, for each item, the manufacturer's name, the serial number of the part, an ordering number, if appropriate, and a physical description of the part.

## 1.06 QUALITY ASSURANCE

- A. Qualifications
1. Layout shall be performed by a NICET Level III or IV Technician certified in Automatic Sprinkler Systems Layout or a Registered Fire Protection Engineer.
  2. Installation shall be performed by a licensed sprinkler contractor who is experienced in the layout and installation of automatic sprinkler systems (minimum 3 years) of comparable size and type.
  3. Installer's responsibilities include layout, fabrication, and installation of sprinkler systems. Layout calculations shall be based on the fire-hydrant flow test data provided.
  4. Drawings shall be sealed by a licensed Professional Fire Protection Engineer or be stamped by a NICET Level III or IV Technician certified in Automatic Sprinkler Systems Layout.
- B. 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.
- C. Applicable References: Fire pump system equipment, specialties, accessories, installation, and testing shall comply with the latest editions of the following codes and standards, unless otherwise indicated:
1. National Fire Protection Association (NFPA), including all amendments and annexes
    - a. NFPA 13 2016, "Installation of Sprinkler Systems."
    - b. NFPA 20 2016, "Centrifugal Fire Pumps"
    - c. NFPA 70 2017, "National Electric Code"
    - d. NFPA 72 2016, "National Fire Alarm Code"
  2. Underwriter's Laboratories (UL)
    - a. "Fire Protection Equipment Directory"
  3. Factory Mutual Global (FM)
    - a. "Approval Guide"
  4. American Standard for Testing Materials (ASTM)

- a. ASTM A795, "Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use"
- 5. National Electrical Manufacturer's Association (NEMA)
  - a. MG 1, "Motors and Generators"
- 6. American Society of Mechanical Engineers (ASME)
  - a. ASME B1.20.1, "Pipe Threads, General Purpose"
  - b. ASME B16.1, "Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250"
  - c. ASME B16.4, "Gray Iron Threaded Fittings"
- D. Guarantee. The Contractor shall guarantee labor, materials, and equipment provided under this contract against defects for a period of one year after the date of final acceptance of this work by the Government. Final Acceptance includes, but is not limited to, the receipt of as-built drawings and operation and maintenance manuals. Contractor shall be able to provide qualified personnel to site within a four (4) hour time frame and be available 24 hours a day, 7 days a week.
- E. Conflicts. The system shall be installed in accordance with the drawings, specifications and referenced publications. Any conflicts between these documents shall be brought to the attention of the Owner, and the GSA Regional Fire Protection Engineer.

## 1.07 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate pump piping with all other trades.
- C. Coordinate pump and controller conduit locations with electrical conduit and wiring requirements.

## PART 2 - PRODUCTS

### 2.01 GENERAL REQUIREMENTS FOR CENTRIFUGAL FIRE PUMPS

- A. All products shall be UL listed or FM approved for Fire Protection Service unless specifically allowed otherwise by this specification.
- B. Description: Factory-assembled and -tested fire-pump and driver unit.
- C. Base: Fabricated and attached to fire-pump and driver unit with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.
- D. All piping shall be steel.
- E. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

### 2.02 IN-LINE FIRE PUMPS

- A. Pump:
  - 1. Casing: Radially split case, cast iron with ASME B16.1 pipe-flange connections.
  - 2. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
  - 3. Wear Rings: Replaceable bronze.
  - 4. Shaft and Sleeve: Steel shaft with bronze sleeve.
    - a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
    - b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
  - 5. Mounting: Pump and driver shaft is vertical, with motor above pump and pump on base.

- B. Coupling: None or rigid.
- C. Driver:
  - 1. Type: Electric motor; NEMA MG 1, polyphase Design B.

**2.03 FIRE PUMP CAPACITIES AND CHARACTERISTICS:**

- 1. Rated Capacity: 750 gpm. 60 HP
- 2. Electrical Characteristics:
  - a. Volts: 208v
  - b. Phases: Three

**2.04 Total Rated Head: 100 psi. FIRE-PUMP ACCESSORIES AND SPECIALTIES**

- A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.
- B. Circulation Relief Valves: Brass, spring loaded; for installation in pump discharge piping.
- C. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.
- D. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.
- E. Hose Valve Manifold Assembly:
  - 1. Standard: Comply with requirements in NFPA 20.
  - 2. Header Pipe: ASTM A795, Schedule 40, galvanized steel with ends threaded according to ASME B1.20.1.
  - 3. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
  - 4. Automatic ball drip drain valve in accordance with NFPA 20.
  - 5. Manifold:
    - a. Test Connections: Provide outlets without clappers instead of inlets.
    - b. Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
    - c. Nipples: ASTM A795, Schedule 40, galvanized-steel pipe with ends threaded according to ASME B1.20.1.
    - d. Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963.
    - e. Escutcheon Plate: Brass or bronze; rectangular.
    - f. Hose Valves: Bronze, with outlet threaded according to NFPA 1963.
    - g. Exposed Parts Finish: Chrome plated.
    - h. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."
  - 6. Manifold:
    - a. Test Connections: Provide outlets without clappers instead of inlets.
    - b. Body: Exposed type, brass, with number of outlets required by NFPA 20.
    - c. Escutcheon Plate: Brass or bronze; round.
    - d. Hose Valves: Bronze, with outlet threaded according to NFPA 1963. Include caps and chains.
    - e. Exposed Parts Finish: Chrome plated.
    - f. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

**2.05 MULTISTAGE, PRESSURE-MAINTENANCE PUMPS**

- A. Description: Factory-assembled and -tested, multistage, barrel-type vertical pump designed for surface installation with pump and motor direct coupled and mounted vertically.
- B. Pump Construction:
  - 1. Barrel: Stainless steel.
  - 2. Suction and Discharge Chamber: Cast iron with flanged inlet and outlet.
  - 3. Pump Head/Motor Mount: Cast iron.

4. Impellers: Stainless steel, balanced, and keyed to shaft.
  5. Pump Shaft: Stainless steel.
  6. Seal: Mechanical type with carbon rotating face and silicon-carbide stationary seat.
  7. Intermediate Chamber Bearings: Aluminum-oxide ceramic or bronze.
  8. Chamber-Base Bearing: Tungsten carbide.
  9. O-Rings: EPDM or NBR.
- C. Motor: Single speed with permanently lubricated ball bearings and rigidly mounted to pump head.
1. Permanently hard-wired to pressure maintenance pump controller.
- D. Nameplate: Permanently attached to pump and indicating capacity and characteristics.
- E. Capacities and Characteristics: TBD
1. Rated Capacity: 7.5 gpm.
  2. Total Dynamic Head: 110
  3. Working Pressure: 175-psig minimum
  4. Inlet and Outlet Size: NPS 1-1/4
  5. Discharge and Suction Flanges: Class 250.
  6. Electrical Characteristics:
    - a. Volts: 208v
    - b. Phases: Three.

## 2.06 FULL-SERVICE CONTROLLERS

- A. General Requirements for Full-Service Controllers:
1. Comply with NFPA 20.
  2. UL listed or FM approved for electric-motor driver for fire-pump service.
  3. Combined automatic and non-automatic operation.
  4. Factory assembled, wired, and tested; continuous-duty rated.
  5. Service Equipment Label: UL listed and labeled for use as service equipment.
- B. Method of Starting:
1. Pressure switch actuated.
    - a. Water-pressure-actuated switch and pressure transducer with independent high- and low-calibrated adjustments responsive to water pressure in fire-suppression piping.
    - b. System pressure recorder, electric ac driven, with spring backup.
    - c. Programmable minimum-run-time relay to prevent short cycling.
  2. Emergency Start: Mechanically operated start handle that closes and retains the motor RUN contactor independent of all electric or pressure actuators.
  3. Solid-state soft start
- C. Method of Stopping: Manual.
- D. Capacity: Rated for fire-pump-driver horsepower and short-circuit-current (withstand) rating equal to or greater than short-circuit current available at controller location.
- E. Method of Isolation and Overcurrent Protection: Interlocked isolating switch and non-thermal MCCB; with a common, externally mounted operating handle, and providing locked-rotor protection.
- F. Door-Mounted Operator Interface and Controls:
1. Monitor, display, and control the devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used.
  2. Method of Control and Indication:
    - a. Microprocessor-based logic controller, with multiline digital readout.

- b. Membrane keypad.
  - c. LED alarm and status indicating lights.
- 3. Local and Remote Alarm and Status Indications:
  - a. Controller power on.
  - b. Motor running condition.
  - c. Loss-of-line power.
  - d. Line-power phase reversal.
  - e. Line-power single-phase condition.
- 4. Audible alarm, with silence push button.
- 5. Manual START and STOP push buttons or switches.
- G. Automatic Transfer Switch (ATS):
  - 1. Complies with NFPA 20.
  - 2. Integral with controller as a listed combination fire-pump controller and power transfer switch.
  - 3. Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure.
  - 4. Allows manual transfer from one source to the other.
  - 5. Alternate-Source Isolating and Disconnecting Means: Mechanically interlocked isolation switch and circuit breaker rated at a minimum of 115 percent of rated motor full-load current, with an externally mounted operating handle; circuit breaker shall be provided with non-thermal sensing, instantaneous-only short-circuit overcurrent protection to comply with available fault currents.
  - 6. Local and Remote Alarm and Status Indications:
    - a. Normal source available.
    - b. Alternate source available.
    - c. In normal position.
    - d. In alternate position.
    - e. Isolating means open.
  - 7. Audible alarm, with silence push button.
  - 8. Manual (nonelectric) means of transfer.
  - 9. Engine test push button.
  - 10. Start generator output contacts.
  - 11. Timer for weekly generator tests.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Fire-Pump Installation Standard: Comply with NFPA 20 and the requirements for this specification for installation of fire pumps, pressure maintenance pumps, relief valves, and related components.
- B. Equipment Mounting: Install fire pumps on concrete bases.
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated by this specification, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
  - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.

- 5. Attach pumps to equipment base using anchor bolts
- C. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.
- D. Support piping and pumps separately so weight of piping does not rest on pumps.
- E. Install pressure gages on fire-pump suction and discharge flange pressure-gage tapings.
- F. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.
- G. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- H. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
- I. Install controllers within sight and within 50 ft. (15 m.) of their respective drivers.
- J. Connect controllers to their dedicated pressure-sensing lines.
- K. Wall-Mounting Controllers: Install controllers on walls with disconnect operating handles not higher than 79 inches (2006 mm) above finished floor, and bottom of enclosure not less than 12 inches (305 mm) above finished floor unless otherwise indicated by this specification. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall.
- L. Floor-Mounting Controllers: Install controllers on 4-inch (100-mm) nominal-thickness concrete bases, using floor stands high enough so that the bottom of enclosure cabinet is not less than 12 inches (305 mm) above finished floor.
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated by this specification, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
  - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.

### **3.02 ALIGNMENT**

- A. Align split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
- B. Align piping connections.
- C. Align pump and driver shafts for angular and parallel alignment according to tolerances specified by manufacturer.

### **3.03 CONNECTIONS**

- A. Comply with requirements for piping and valves specified in "Wet-Pipe Sprinkler Systems." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps and equipment to allow service and maintenance.

### **3.04 REMOTE INSTALLATION**

- A. Install panels on walls with tops not higher than 72 inches above finished floor unless otherwise indicated by this specification. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For ATS not on walls, provide freestanding racks

### **3.05 POWER WIRING INSTALLATION**

- A. Install power wiring between controllers and their services or sources, and between controllers and their drivers. Comply with requirements in NFPA 20 and NFPA 70.

### **3.06 CONTROL AND ALARM WIRING INSTALLATION**

- A. Install wiring between controllers and remote devices and facility's central monitoring system. Comply with requirements in NFPA 20 and NFPA 70.
- B. Install wiring between remote alarm panels and controllers. Comply with requirements in NFPA 20 and NFPA 70.
- C. Install wiring between controllers and the building's fire-alarm system. Comply with requirements specified in NFPA 72 and Division 28 Digital Fire Alarm.
- D. Bundle, train, and support wiring in enclosures.
- E. Connect remote manual and automatic activation devices where applicable.

### **3.07 IDENTIFICATION**

- A. Identify system components. Comply with requirements for fire-pump and fire pump controller marking according to NFPA 20.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification in NFPA 20.

### **3.08 FIELD QUALITY CONTROL**

- A. Test each fire pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in this Section."
- B. Pretest: Prior to final acceptance and inspection, engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Tests and Inspections:
  - 1. Do not begin field acceptance testing until suction piping has been flushed and hydrostatically tested and the certificate for flushing and testing has been submitted to Regional Fire Protection Engineer and authorities having jurisdiction.
  - 2. Prior to starting, notify authorities having jurisdiction of the time and place of the acceptance testing.
  - 3. Engage manufacturer's factory-authorized service representative to be present during the testing.
  - 4. After installing components, assemblies, and equipment including controller, test for compliance with requirements.
  - 5. Test according to NFPA 20 for acceptance and performance testing.
  - 6. Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.
  - 7. Test insulation resistance for each element, component, connecting supply, feeder, and control circuits.
  - 8. Test continuity of each circuit.
  - 9. Test each motor for proper phase rotation.



- D. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.
- G. Coordination of Installation:
  - 1. The Contractor shall coordinate this fire pump work with other trades to avoid conflicts, assure system completion and testing within the project schedule and to assure a quality, workmanlike finished product.

### **3.09 ADJUSTING**

- A. Lubricate pumps as recommended by manufacturer.
- B. Set field-adjustable switches, auxiliary relays, time-delay relays, and timers ranges as indicated
- C. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing.
- D. Set field-adjustable pressure switches.

### **3.10 PROTECTION**

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.
- B. Replace controllers whose interiors have been exposed to water or other liquids.

### **3.11 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire pumps and fire pump controllers, remote alarm panels, low-suction-shutdown panels, and to use and reprogram microprocessor-based controls within this equipment.

### **3.12 CLEANING AND PAINTING**

- A. Clean dirt and debris.
- B. Paint pipe as required by Division 9, Painting.

END OF SECTION 21 31 13

## SECTION 22 0500 - BASIC PLUMBING REQUIREMENTS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Requirements applicable to all Division 22 Sections. Also refer to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

#### 1.02 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Scope of Work:
  - 1. Plumbing Work shall include, but is not necessarily limited to:
    - a. Furnish and install all items listed in the Plumbing Material List.
    - b. Furnish and install a new domestic water service to the building.
    - c. Furnish and install a complete domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
    - d. Furnish and install complete gas piping system including all meter requirements.
    - e. Furnish and install water softener.
    - f. Furnish and install water heaters.
    - g. Furnish and install complete storm water drainage system.
    - h. Furnish and install condensate drain piping from plumbing related equipment such as ice machines.
    - i. Furnish and install complete sanitary sewer and vent system.
    - j. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
  - 2. Heating Work: Refer to Section 23 0500 "Basic HVAC Requirements".
  - 3. Air Conditioning and Ventilating Work: Refer to Section 23 0500 "Basic HVAC Requirements".
  - 4. Temperature Control Work: Refer to Section 23 0500 "Basic HVAC Requirements".
  - 5. Testing, Adjusting, and Balancing Work: Refer to Section 23 0500 "Basic HVAC Requirements".

**1.03 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS**

A. Definitions:

1. "Mechanical Contractors" refers to the following:
  - a. Plumbing Contractor.
  - b. Heating Contractor.
  - c. Air Conditioning and Ventilating Contractor.
  - d. Temperature Control Contractor.
  - e. Fire Protection Contractor.
  - f. Testing, Adjusting, and Balancing Contractor.
2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
  - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
  - a. Light fixtures.
  - b. Gravity flow piping, including steam and condensate.
  - c. Electrical busduct.
  - d. Sheet metal.
  - e. Electrical cable trays, including access space.
  - f. Sprinkler piping and other piping.
  - g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
  - a. Boiler Feed Pumps.
  - b. Burners.
  - c. Condensing Units.
  - d. Electric Humidifiers.
  - e. Packaged Rooftop Units.
2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
4. Temperature Control Contractor's Responsibility:
  - a. Wiring of all devices needed to make the Temperature Control System functional.

- b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Subcontractor.
  - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

#### 1.04 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
  - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
  - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
  - c. Maintenance clearances and code-required dedicated space shall be included.
  - d. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
  - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
  - a. Scale of drawings:
    - 1) General plans: 1/4 Inch = 1'-0" (minimum).
    - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
    - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
    - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
    - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.

5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
  - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
  - b. Potential layout changes shall be made to avoid additional access panels.
  - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
  - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
  - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

## **1.05 QUALITY ASSURANCE**

### **A. Contractor's Responsibility Prior to Submitting Pricing Data:**

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

### **B. Qualifications:**

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Shiprock New Mexico Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to Federal Act S.3874 requiring the reduction of lead in drinking water.
3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.

E. Utility Company Requirements:

1. Secure from the appropriate private or public utility company all applicable requirements.
2. Comply with all utility company requirements.
3. Make application for and pay for service connections, such as sewer and water and gas.
4. Make application for and pay for all meters and metering systems required by the utility company.

F. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.



## 1.06 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

Referenced Specification Section	Submittal Item
22 05 03	Fire Seal Systems
22 05 29	Hangers and Supports
22 05 53	Plumbing Identification
22 07 19	Plumbing Pipe Insulation
22 09 00	Instrumentation
22 10 00	Plumbing Piping Systems and Valves
22 10 23	Natural Gas and Propane Piping Systems
22 10 30	Plumbing Specialties
22 14 29	Sump Pumps
22 40 00	Plumbing Fixtures

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Division of work (e.g., plumbing, heating, ventilating, etc.)
- e. Description of items submitted and relevant specification number
- f. Notations of deviations from the contract documents
- g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number
- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Division of work (e.g., plumbing, heating, ventilating, etc.)
- g. Description of item submitted (using project nomenclature) and relevant specification number
- h. Notations of deviations from the contract documents
- i. Other pertinent data
- j. Provide space for Contractor's review stamps

3. Composition:

- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.

- b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
  - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
- 4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
- 5. Contractor's Approval Stamp:
  - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
  - b. Unstamped submittals will be rejected.
  - c. The Contractor's review shall include, but not be limited to, verification of the following:
    - 1) Only approved manufacturers are used.
  - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
  - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
- 6. Submittal Identification and Markings:
  - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
  - b. The Contractor shall clearly indicate the size, finish, material, etc.
  - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
  - d. All marks and identifications on the submittals shall be unambiguous.
- 7. Schedule submittals to expedite the project. Coordinate submission of related items.
- 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
- 9. Reproduction of contract documents alone is not acceptable for submittals.
- 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
- 11. Submittals not required by the contract documents may be returned without review.

12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
  - a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.
16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
  - a. Submittal file name: 22 XX XX.description.YYYYMMDD
  - b. Transmittal file name: 22 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

## 1.07 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
  1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
  2. Submit in Excel format.
  3. Support values given with substantiating data.
- C. Preparation:

1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
2. Break down all costs into:
  - a. Material: Delivered cost of product with taxes paid.
  - b. Labor: Labor cost, excluding overhead and profit.
3. Itemize the cost for each of the following:
  - a. Overhead and profit.
  - b. Bonds.
  - c. Insurance.
  - d. General Requirements: Itemize all requirements.
4. For each line item having an installed cost of more than \$5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:
  - a. Excavation and backfill for underground piping systems inside the building.
  - b. Underground piping systems inside the building (sanitary, storm, etc.) listed separately. Break down the material and labor for each piping system based on geography (building, floor, wing and/or phase).
  - c. Each aboveground piping system (sanitary, storm, domestic water, etc.). Break down the material and labor for each piping system based on geography (building, floor, wing and/or phase).
  - d. Pipe insulation with separate material and labor line items for each piping system listed above.
  - e. Each piece of equipment requiring shop drawings (e.g., backflow preventer, water heater, water softener, etc.) using the project nomenclature (BFP-1, WH-1, WS-1, etc.).
  - f. Each plumbing fixture (e.g., WC, lavatory, sink, etc.). Multiple units of the same type can be listed together, provided quantities are also listed so unit costs can be determined.
  - g. Water balancing
  - h. Record drawings
  - i. Punchlist and closeout

D. Update Schedule of Values when:

1. Indicated by Architect/Engineer.

#### **1.08 CHANGE ORDERS**

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

## **1.09 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE**

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

## **1.10 NETWORK / INTERNET CONNECTED EQUIPMENT**

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

## **1.11 WARRANTY**

- A. Provide two-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

## **1.12 INSURANCE**

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

## **1.13 MATERIAL SUBSTITUTION**

- A. Where several manufacturers' names are given, the first manufacturer is the basis for job design and establishes the quality.

- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractor's part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

## **PART 2 - EXECUTION**

### **2.01 JOBSITE SAFETY**

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

### **2.02 EXCAVATION, FILL, BACKFILL, COMPACTION**

- A. General:
  - 1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (<https://call811.com/>) or by calling 811.
  - 2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.
- B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workers.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Fill and Backfilling:

1. Utilities Bedding: Lay underground utilities on minimum of 6" sand bedding or. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
2. Envelope around utilities to 6" above utilities: Place and compact sand or to a height of 6" over utilities in 6" layers. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
3. Backfill from 6" above utilities to earthen grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
4. Backfill from 6" above utilities to below slabs or paved area: Where the fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
5. Backfill Materials: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Backfill material shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Water shall not be permitted to rise in unbackfilled trenches.
6. Dispose of excess excavated earth as directed.
7. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.

8. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

E. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

### **2.03 ARCHITECT/ENGINEER OBSERVATION OF WORK**

A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
  - a. Pipe insulation is installed and fully sealed.
  - b. Pipe wall penetrations are sealed.
  - c. Pipe identification and valve tags are installed.
2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

### **2.04 PROJECT CLOSEOUT**

A. The following paragraphs supplement the requirements of Division 1.

B. IDPH Final Occupancy Checklist for Request of Inspection:

1. Each Contractor must submit all forms and certifications required by IDPH relating to their work at 85% completion of the project or when directed by the Owner/Architect/Engineer.

C. Final Jobsite Observation:



1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

D. Before final payment is authorized, this Contractor must submit the following:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including reproducible drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

## **2.05 OPERATION AND MAINTENANCE MANUALS**

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
  - a. O&M file name: O&M.div22.contractor.YYYYMMDD
  - b. Transmittal file name: O&Mtransmittal.div22.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.
16. Owner and Contractor attendance list for domestic water systems operation, maintenance, and flushing training.

**2.06 INSTRUCTING THE OWNER'S REPRESENTATIVES**

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.

- D. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- E. Operating Instructions:
  - 1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
  - 2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

## **2.07 SYSTEM STARTING AND ADJUSTING**

- A. The plumbing systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Contractor shall adjust the plumbing systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- D. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- E. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

## **2.08 RECORD DOCUMENTS**

- A. The following paragraphs supplement Division 1 requirements.
- B. Maintain at the job site a separate and complete set of plumbing drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

- C. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations devices, requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.
- D. Before completion of the project, a set of reproducible plumbing drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.
- E. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- F. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- G. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

## **2.09 ADJUST AND CLEAN**

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.
- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

## **2.10 SPECIAL REQUIREMENTS**

- A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

## **2.11 UTILITY REBATE**

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.

1. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

## READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All pumps operating and balanced.
3. All plumbing fixtures installed and caulked.
4. Pipe insulation complete, pipes labeled and valves tagged.

**END OF SECTION**

## SECTION 22 0503 - THROUGH PENETRATION FIRESTOPPING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Through-Penetration Firestopping.

#### 1.02 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

#### 1.03 REFERENCES

- A. UL 263 - Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. 2015New Mexico Commercial Building Code

#### 1.04 SUBMITTALS

- A. Submit under provisions of Section 22 0500.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
  - 1. Types of penetrating items.
  - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.

3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
  4. F ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

#### **1.06 PERFORMANCE REQUIREMENTS**

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
  2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

#### **1.07 MEETINGS**

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
1. Review foreseeable methods related to firestopping work.



2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

#### **1.08 WARRANTY**

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
  1. 3M; Fire Protection Products Division.
  2. Hilti, Inc.
  3. RectorSeal Corporation, Metacaulk.
  4. Tremco; Sealant/Weatherproofing Division.
  5. Johns-Manville.
  6. Specified Technologies Inc. (S.T.I.)
  7. Spec Seal Firestop Products
  8. AD Firebarrier Protection Systems
  9. Dow Corning Corp.
  10. Fire Trak Corp.
  11. International Protective Coating Corp.

#### **2.02 THROUGH PENETRATION FIRESTOP SYSTEMS**

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.
- E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- F. Provide firestopping systems allowing continuous insulation for all insulated pipes.

G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

- a. F Rating = Floor/Wall Rating
- b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

- a. F Rating = Floor/Wall Rating
- b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

- a. F Rating = Wall/Floor Rating
- b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999

Penetrating Item	UL System No.
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

- H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

#### **3.02 INSTALLATION**

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

### **3.03 CLEANING AND PROTECTING**

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

**END OF SECTION**

## SECTION 22 0529 - PLUMBING SUPPORTS AND ANCHORS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Hangers, Supports, and Associated Anchors.
- B. Equipment Bases and Supports.
- C. Sleeves and Seals.
- D. Flashing and Sealing of Equipment and Pipe Stacks.
- E. Cutting of Openings.
- F. Escutcheon Plates and Trim.

#### 1.02 REFERENCES

- A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
- C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices
- D. MSS SP-127 - Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application.

#### 1.03 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 22 0500. Include plastic pipe manufacturers' support spacing requirements.

#### 1.04 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

### PART 2 - PRODUCTS

#### 2.01 HANGER RODS

- A. Hanger rods for single rod hangers shall conform to the following:

Pipe Size	Hanger Rod Diameter	
	Column #1	Column #2
2-1/2" and smaller	3/8"	3/8"
3" through 3-5/8"	3/8"	3/8"
4" and 5"	1/2"	1/2"

6"	3/4"	5/8"
8" through 12"	7/8"	3/4"
14"	1"	7/8"
16" and 18"	1"	N/A
20" and 24"	1-1/4"	N/A

Column #1: Steel, cast iron, and glass pipe.

Column #2: Copper and plastic pipe.

- B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.
- C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
- D. All hanger rods, nuts, washers, clevises, etc., in damp areas shall have ASTM A123 hot-dip galvanized finish applied after fabrication. This applies to the following areas:

## 2.02 PIPE AND STRUCTURAL SUPPORTS

### A. General:

1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).
2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.
3. Copper piping located in an exposed area, including indirect waste piping in kitchens and janitor's closets, shall use split ring standoff hangers for copper tubing. Support shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp. Use electro-galvanized or more corrosion resistant and threaded rod for floor applications. Use anchors applicable to the wall type with corrosion resistant threaded rod for wall applications.

#### a. Products:

- 1) Erico/M-Co Model #456
- 2) B-Line Fig. 3198HCT
- 3) Anvil Fig. CT138R
- 4) Nibco/Tolco Fig. 301CT

### B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, unless otherwise noted by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings, or lugs. Provide sufficient flexibility to accommodate expansion and contraction to avoid compromising fire barrier penetrations or stressing piping at fixed takeoff locations.

#### a. Products:

- 1) Cooper/B-Line Fig B3373 Series
- 2) Erico 510 Series

- 3) Nibco/Tolco Fig. 82
2. Cold Pipe: Place restrained neoprene mounts beneath vertical pipe riser clamps to prevent sweating of cold pipes. Select neoprene mounts based on the weight of the pipe to be supported. Insulate over mounts.
    - a. Products:
      - 1) Mason RBA, RCA or RDA
      - 2) Mason BR
  3. Cold Pipe Alternative: Insulated pipe riser clamp with no thermal bridging between clamp and pipe; water repellant calcium silicate insulation material adhered inside the clamp; ASTM A653 galvanized steel clamp.
    - a. Products:
      - 1) Pipeshields E100
  4. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs. Wall supports shall be coordinated with the Structural Engineer.
  5. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.
- C. Hangers and Clamps:
1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
  2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp within their temperature limits of -65°F to +275°F.
  3. Vertical cold pipe drops and rough-ins to fixtures shall be supported by insulated pipe clamps to prevent thermal bridging and condensation.
  4. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
  5. Ferrous hot piping 4 inches and larger shall have steel saddles tack welded to the pipe at each support with a depth not less than specified for the insulation. Factory fabricated inserts may be used.
    - a. Products:
      - 1) Anvil Fig. 160, 161, 162, 163, 164, 165
      - 2) Cooper/B-Line Fig. 3160, 3161, 3162, 3163, 3164, 3165.
      - 3) Erico Model 630, 631, 632, 633, 634, 635.
      - 4) Nibco/Tolco Fig. 260-1, 261-1 1/2, 262-2, 263-2 1/2, 264-3, 265-4
  6. Unless otherwise indicated, hangers shall be as follows:
    - a. Clevis Type:

- 1) Service: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches & Smaller
  - 2) Products: Bare Steel Plastic or Insulated Pipe:
    - a) Anvil Fig. 260
    - b) Cooper/B-Line Fig. 3100
    - c) Erico Model 400
    - d) Nibco/Tolco Fig. 1
  - 3) Products: Bare Copper Pipe:
    - a) Cooper/B-Line Fig. B3100C
    - b) Nibco/Tolco Fig. 81PVC
7. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.
- a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
  - b. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.
8. Unless otherwise indicated, pipe supports for use with struts shall be as follows:
- a. Clamp Type:
    - 1) Service: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches and smaller
    - 2) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp.
    - 3) Pipes subject to expansion and contraction shall have clamps oversized to allow limited pipe movement.
    - 4) Bare Steel, Plastic or Insulated Pipe:
      - a) Unistrut Fig. P1100 or P2500
      - b) Cooper/B-Line Fig. B2000 or B2400
      - c) Nibco/Tolco Fig. A-14 or 2STR
    - 5) Bare Copper Pipe:
      - a) Cooper/B-Line Fig. BVT

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:
  - a. Steel Structure Clamps: C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists.):



- 1) Products:
  - a) Anvil Fig. 92
  - b) Cooper/B-Line Fig. B3033/B3034
  - c) Erico Model 300
  - d) Nibco/Tolco 68
  
- b. Steel Structure Clamps: Scissor Type Beam Clamps (for use with bar-joists and wide flange):
  - 1) Products:
    - a) Anvil Fig. 228, 292
    - b) Cooper/B-Line Fig. B3054
    - c) Erico Model 360
    - d) Nibco/Tolco Fig. 329
  
- c. Concentrically Loaded Open Web Joist Hangers (for use with bar joists):
  - 1) Products:
    - a) MCL. M1, M2 or M3
  
- d. Concrete: Concrete Inserts, Single Rod Galvanized:
  - 1) Products:
    - a) Anvil Fig. 282
    - b) Cooper/B-Line Fig. B3014
    - c) Erico Model 355
    - d) Nibco/Tolco Fig. 310

## **2.03 FOUNDATIONS, BASES, AND SUPPORTS**

### **A. Basic Requirements:**

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

### **B. Concrete Bases (Housekeeping Pads):**

1. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 3 inches on all sides of the equipment (6 inches larger than factory base).
2. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a "dirt-trap".

3. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6"x6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days.
4. Equipment requiring bases is as follows:
  - a. Pressure Booster Pump
  - b. Water Heater
  - c. Water Softener

#### **2.04 OPENINGS IN FLOORS, WALLS AND CEILINGS**

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.
- F. Exposed Housing Penetrations: Seal pipes with surface temperature below 150°F, penetrating housings with conical stepped, white silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite.

#### **2.05 ROOF PENETRATIONS**

- A. Roof Curb Enclosure: Provide weatherproof roof curb and enclosure for pipe penetrations. Refer to drawings for details.
- B. Conical Pipe Boot: Seal pipes with surface temperature below 150°F penetrating single-ply roofs with conical stepped, UV-resistant silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite. Color: White shall match roofing membrane.
- C. Break insulation only at the clamp for pipes between 60°F and 150°F. Seal outdoor insulation edges watertight.

#### **2.06 SLEEVES AND LINTELS**

- A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.
- B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.

- C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.
- D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas.
- E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Architect/Engineer's design.
- F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
- G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
- H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (e.g., foam, rubber, asphalt-coated fiber, bituminous-impregnated felt, or cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
- I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

#### **2.07 ESCUTCHEON PLATES AND TRIM**

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.
- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.
- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

#### **2.08 PIPE PENETRATIONS**

- A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.
- B. Seal fire rated wall and floor penetrations with fire seal system as specified.

#### **2.09 PIPE ANCHORS**

- A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.
- B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

## **2.10 FINISH**

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

## **PART 3 - EXECUTION**

### **3.01 PLUMBING SUPPORTS AND ANCHORS**

- A. General Installation Requirements:

1. Install all items per manufacturer's instructions.
2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with sheet metal contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.

- B. Supports Requirements:

1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
2. Set all concrete inserts in place before pouring concrete.
3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

- C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

- D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
  2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
    - a. The hanger is attached within 6" from a web/chord joint.
    - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
  3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
  4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
- H. Steel/Concrete Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:
1. Steel (Std. Weight or Heavier - Vapor Service):
    - a. Maximum Spacing:
      - 1) 1-1/4" and under: 9'-0"
      - 2) 1-1/2": 12'-0"
      - 3) 2" & larger: 12'-0"
  2. Hard Drawn Copper & Brass (Liquid Service):
    - a. Maximum Spacing:
      - 1) 3/4" and under: 5'-0"
      - 2) 1": 6'-0"
      - 3) 1-1/4": 7'-0"
      - 4) 1-1/2": 8'-0"
      - 5) 2": 8'-0"
      - 6) 2-1/2": 9'-0"

- 7) 3": 10'-0"
- 8) 4": 12'-0"
- 9) 6": 12'-0"

3. Plastic Pipe:

- a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.

4. Ultra-Flexible Pipe, and Flexible Hose, and Soft Copper Tubing:

- a. Continuous channel with hangers maximum 8'-0" OC.

I. Installation of hangers shall conform to MSS SP-58, 69, 89 and the applicable Plumbing Code.

**END OF SECTION**

## SECTION 22 0553 - PLUMBING IDENTIFICATION

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Identification of products installed under Division 22.

#### 1.02 REFERENCES

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.
- B. ASTM B-1, B-3, and B-8 for copper conductors.
- C. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 " 2kV Cables.
- D. CGA Pamphlet C-9, Standard Color-Marking of Compressed Gas Cylinders for Medical Use.
- E. NFPA-99 " Health Care Facilities.
- F. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

#### 1.03 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 0500. Include list of items identified, wording, letter sizes, and color coding.
- B. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

1. 3M
2. Bunting
3. Calpico
4. Craftmark
5. Emedco
6. Kolbi Industries
7. Seton
8. W.H. Brady
9. Marking Services

#### 2.02 MATERIALS

- A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

OD of Pipe or Insulation	Marker Length	Size of Letters
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"
8" to 10"	24"	2-1/2"
Over 10"	32"	3-1/2"

Plastic tags may be used for outside diameters under 3/4"

- B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
- C. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.
- D. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.
- E. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.
- F. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install all products per manufacturer's recommendations.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Valves:
  1. All valves (except shutoff valves at equipment) shall have numbered tags.
  2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
  3. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
  4. Attach to handwheel or around valve stem. On lever operated valves, drill the lever to attach tags.
  5. Number all tags and show the service of the pipe.
  6. Provide one Plexiglas framed valve directory listing all valves, with respective tag numbers, uses and locations. Mount directory in location chosen by the Architect/Engineer.
  7. Provide two sets of laminated 8-1/2" x 11" (letter size) copies of a valve directory listing all valves, with respective tag numbers, uses, and locations. The directory shall be reviewed by the Owner and Architect/Engineer prior to laminating final copies. Laminated copies shall have brass eyelet in at least one corner for easy hanging.
- D. Pipe Markers:



1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
3. Stencil Painted Pipe Markers:
  - a. Remove rust, grease, dirt, and all foreign substances from the pipe surface.
  - b. Apply primer on non-insulated pipes before painting.
  - c. Use background and letter colors as scheduled later in this section.
4. Apply markers and arrows in the following locations where clearly visible:
  - a. At each valve.
  - b. On both sides of walls that pipes penetrate.
  - c. At least every 20 feet along all pipes.
  - d. On each riser and each leg of each "T" joint.
  - e. At least once in every room and each story traversed.
5. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.

E. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
2. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

### 3.02 SCHEDULE

- A. Pipes to be marked shall be labeled with text as follows, regardless of which method or material is used:
1. CONDENSATE DRAIN: White lettering; green background
  2. DOMESTIC COLD WATER: White lettering; green background
  3. DOMESTIC HOT WATER - 140°F: White lettering; green background
  4. DOMESTIC HOT WATER CIRCULATING - 140°F: White lettering; green background
  5. SANITARY SEWER: Black lettering; yellow background
  6. VENT: Black lettering; yellow background
  7. STORM SEWER (PRIMARY AND SECONDARY): White lettering; green background
  8. NATURAL GAS: Black lettering; yellow background

**END OF SECTION**

## SECTION 22 0593 - PLUMBING TESTING, ADJUSTING, AND BALANCING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Testing, adjusting, and balancing of plumbing systems.

#### 1.02 QUALITY ASSURANCE

- A. Agency shall be a company specializing in the adjusting and balancing of systems specified in this section with minimum three years' experience. Perform work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, SMARTA Certified Air and Hydronic Balancer, or TABB Certified Supervisor.
- B. Work shall be performed in accordance with the requirements of the references listed at the start of this section.

#### 1.03 REFERENCES

- A. AABC - National Standards for Total System Balance, 2002.
- B. ASHRAE - 2003 HVAC Applications Handbook; Chapter 37, Testing, Adjusting and Balancing.
- C. TABB - International Standards for Environmental Systems Balance.

#### 1.04 SUBMITTALS

- A. Electronic Copies:
  - 1. Submit a certified copy of test reports to the Architect/Engineer for approval. Electronic copies shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Copies that are not legible will be returned to the Contractor for resubmittal. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
  - 2. Electronic file size shall be limited to a maximum of 10MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
  - 3. All text shall be searchable.
  - 4. Bookmarks shall be used. All bookmark titles shall be an active link to the index page and index tabs.

#### 1.05 REPORT FORMS

- A. Submit reports on AABC, SMACNA or NEBB forms. Use custom forms approved by the Architect/Engineer when needed to supply specified information.
- B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.
- C. Refer to PART 4 for required reports.

## **1.06 WARRANTY/GUARANTEE**

- A. The TAB Contractor shall include an extended warranty of 90 days after owner receipt of a completed balancing report, during which time the Owner may request a recheck of terminals, or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of 24 manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.
- B. Warranty/Guarantee must meet one of the following programs: TABB International Quality Assurance Program, AABC National Project Performance Guarantee, NEBB's Conformance Certification.

## **1.07 SCHEDULING**

- A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Architect/Engineer prior to performing each test.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION**

### **3.01 GENERAL REQUIREMENTS**

- A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the contract documents shall be balanced using a procedure from a published standard listed in the References article.
- B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g., submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.
- C. Recorded data shall represent actual measured or observed conditions.
- D. Cut insulation, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.
- E. Permanently mark setting of valves and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
- F. Leave systems in proper working order, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.
- G. Installations with systems consisting of multiple components shall be balanced with all system components operating.

### **3.02 EXAMINATION**

- A. Before beginning work, verify that systems are complete and operable. Ensure the following:
  - 1. General Equipment Requirements:
    - a. Equipment is safe to operate and in normal condition.
    - b. Equipment with moving parts is properly lubricated.
    - c. Temperature control systems are complete and operable.
    - d. Proper thermal overload protection is in place for electrical equipment.
    - e. Direction of rotation of all pumps is correct.
    - f. Access doors are closed and end caps are in place.
  - 2. Pipe System Requirements:
    - a. Strainer screens are clean and in place.
    - b. Shutoff, throttling and balancing valves are open.
- B. Report any defects or deficiencies to Architect/Engineer.
- C. Promptly report items that are abnormal or prevent proper balancing.
- D. If, for design reasons, system cannot be properly balanced, report as soon as observed.
- E. Beginning of work means acceptance of existing conditions.

### **3.03 PREPARATION**

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect/Engineer for spot checks during testing.
- B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

### **3.04 INSTALLATION TOLERANCES**

- A.  $\pm 10\%$  of scheduled values:
  - 1. Adjust piping systems to  $\pm 10\%$  of design values.

### **3.05 ADJUSTING**

- A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.
- B. Once balancing of systems is complete, at least one valve must be 100% open.
- C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.
- D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.

- E. Contractor responsible for pump shall trim impeller to final duty point as instructed by this contractor on all pumps not driven by a VFD. Coordinate with contractor.

### **3.06 SUBMISSION OF REPORTS**

- A. Fill in test results on appropriate forms.

## **PART 4 - SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED**

### **4.01 GENERAL REQUIREMENTS**

- A. Instrument List:
  - 1. Instrument.
  - 2. Manufacturer, model, and serial number.
  - 3. Range.
  - 4. Calibration date.

### **4.02 PLUMBING SYSTEMS**

- A. Pump Data:
  - 1. Drawing symbol.
  - 2. Service.
  - 3. Manufacturer, size, and model.
  - 4. Impeller size: specified, actual, and final (if trimmed).
  - 5. Flow Rate (gpm): specified and actual.
  - 6. Pump Head: specified, operating and shutoff.
  - 7. Suction Pressure: operating and shutoff.
  - 8. Discharge Pressure: operating and shutoff.
- B. Electric Motors:
  - 1. Drawing symbol of equipment served.
  - 2. Manufacturer, model, frame.
  - 3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
  - 4. Measured: Amps for each phase.
- C. Balancing Valve:
  - 1. Drawing symbol.
  - 2. Service.
  - 3. Location.
  - 4. Size.
  - 5. Manufacturer and model.
  - 6. Flow rate (gpm): specified and actual.
  - 7. Pressure drop: specified and actual.
- D. Gas Fired Water Heater:
  - 1. Drawing symbol.

2. Service.
3. Location.
4. Manufacturer and model.
5. Flow rate (gpm): specified and actual.
6. Pressure drop: specified and actual.
7. Capacity (Btuh ): specified, nameplate, and actual.
8. Entering water temperature: specified and actual.
9. Leaving water temperature: specified and actual.
10. Control Setting: specified and actual.

**END OF SECTION**

## SECTION 22 0719 - PLUMBING PIPING INSULATION

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Piping Insulation.

#### 1.02 QUALITY ASSURANCE

- A. Applicator: Company specializing in piping insulation application with five years minimum experience.
- B. Materials: Listed and labeled for flame spread/smoke developed rating of no more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
- C. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

#### 1.03 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- C. ANSI/ASTM C534 - Elastomeric Foam Insulation.
- D. ASTM C591 - Unfaced Preformed Rigid Cellular Polyisocyanurate Insulation.
- E. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
- F. ASTM C1729 - Standard Specification for Aluminum Jacketing for Insulation.
- G. ASTM C1767 - Standard Specification for Stainless Steel Jacketing for Insulation.
- H. ASTM E84 - Surface Burning Characteristics of Building Materials.
- I. NFPA 255 - Surface Burning Characteristics of Building Materials.
- J. UL 723 - Surface Burning Characteristics of Building Materials.

- K. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

#### **1.04 SUBMITTALS**

- A. Submit shop drawings per Section 22 0500. Include product description, list of materials and thickness for each service, and locations.

### **PART 2 - PRODUCTS**

#### **2.01 INSULATION**

- A. Type A: Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible. All-purpose polymer or polypropylene service jacket, listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.
- B. Type B: Flexible elastomeric foam insulation; closed-cell, sponge or expanded rubber (polyethylene type is not permitted); ANSI/ASTM C534 Grade 1 Type I for tubular materials; flexible plastic; 0.25 maximum 'K' value at 75°F, listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Maximum 1" thick per layer where multiple layers are specified.

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

- A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.

#### **3.02 INSTALLATION**

- A. General Installation Requirements:
  - 1. Install materials per manufacturer's instructions, building codes and industry standards.
  - 2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.
- B. Insulated Piping Operating Between 60°F and 140°F:
  - 1. Do not insulate flanges and unions, but bevel and seal ends of insulation at such locations. Insulate all fittings, valves and strainers.
- C. Exposed Piping:
  - 1. Locate and cover seams in least visible locations.
  - 2. Where exposed insulated piping extends above the floor, provide a sheet metal guard around the insulation extending 12" above the floor. Guard shall be 0.016" cylindrical smooth or stucco aluminum and shall fit tightly to the insulation.



3. On exposed piping serving kitchen equipment or plumbing fixtures, the piping shall be insulated unless local code allows it to be uninsulated. In no instance should the uninsulated portion of the piping be more than 4ft in developed length.

### 3.03 SUPPORT PROTECTION

- A. Provide a shield on all insulated piping at each support between the insulation jacket and the support.
- B. On all insulated piping greater than 1-1/2", provide shield with insulation insert of same thickness and contour as adjoining insulation at each support, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Inserts shall be as follows:
  1. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a minimum 180° cylindrical segment the same length as metal shields. Inserts shall be:
    - a. Molded hydrous calcium silicate (only use for pipes with operating temperatures above 90°F, with a minimum compressive strength of 100 psi is acceptable for pipe sizes 14" and below. For pipe sizes larger than 14", provide rolled steel plate in addition to the shield.
    - b. As an alternative to separate pipe insulation insert and saddle, properly sized manufactured integral rigid insulation insert and shield assemblies may be used.
      - 1) Products:
        - a) Buckaroo CoolDry
        - b) Cooper/B-Line Fig. B3380 through B3384
        - c) Pipe Shields A1000, A2000
      - c. Insulation Couplings:
        - 1) Molded thermoplastic slip coupling, -65°F to 275°F, sizes up to 4-1/8" OD, and receive insulation thickness up to 1". Suitable for use indoors or outdoors with UV stabilizers. Vertical insulation riser clamps shall have a 1,000lb vertical load rating. On cold pipes operating below 60°F, cover joint and coupling with vapor barrier mastic to ensure continuous vapor barrier.
        - 2) Horizontal Strut Mounted Insulated Pipe Manufacturers:
          - a) Klo-Shure or equal
        - 3) Vertical:
          - a) Manufacturers: Klo-Shure Titan or equal
      - d. Rectangular blocks, plugs, or wood material are not acceptable.
      - e. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.
  - C. Neatly finish insulation at supports, protrusions, and interruptions.

D. Install metal shields between all hangers or supports and the pipe insulation. Shields shall be galvanized sheet metal, half-round with flared edges. Adhere shields to insulation. On cold piping, seal the shields vapor-tight to the insulation as required to maintain the vapor barrier, or add separate vapor barrier jacket.

E. Shields shall be at least the following lengths and gauges:

Pipe Size	Shield Size
1/2" to 3-1/2"	12" long x 18 gauge
4"	12" long x 16 gauge
5" to 6"	18" long x 16 gauge
8" to 14"	24" long x 14 gauge
16" to 24"	24" long x 12 gauge

F. Ferrous hot piping 4 inches and larger, provide steel saddle at rollers as described in Section 22 0529 "Plumbing Supports and Anchors".

G. Minimum 1/4" rolled galvanized steel plates shall be provided in addition to the sleeves as reinforcement on large pipes to reduce point loading on roller, trapeze hanger and strut support locations depending on insulation compressive strength. Refer to section above for exact locations.

### 3.04 INSULATION

A. Type A Insulation:

1. All Service Jackets: Seal all longitudinal joints with self-seal laps using a single pressure sensitive adhesive system. Do not staple.
2. Insulation without self-seal lap may be used if installed with Benjamin Foster 85-20 or equivalent Chicago Mastic, 3M or Childers lap adhesive.
3. Apply insulation with laps on top of pipe.
4. Fittings, Valve Bodies and Flanges: For 4" and smaller pipes, insulate with 1 lb. density insulation wrapped under compression to a thickness equal to the adjacent pipe insulation. For pipes over 4", use mitered segments of pipe insulation. Finish with preformed plastic fitting covers. Secure fitting covers with pressure sensitive tape at each end. Overlap tape at least 2" on itself. For pipes operating below 60°F seal fitting covers with vapor retarder mastic in addition to tape.

B. Type B Insulation:

1. Install per manufacturer's instructions or ASTM C1710.
2. Elastomeric Cellular Foam: Where possible, slip insulation over the open end of pipe without slitting. Seal all butt ends, longitudinal seams, and fittings with adhesive. At elbows and tees, use mitered connections. Do not compress or crush insulation at cemented joints. Joints shall be sealed completely and not pucker or wrinkle. Paint the outside of outdoor insulation with two coats of latex enamel paint recommended by the manufacturer.
3. Insulation Installation on Straight Pipes and Tubes:

- a. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
  - b. Insulation must be installed in compression to allow for expansion and contraction. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
4. Insulation Installation on Valves and Pipe Specialties:
- a. Install preformed sections of same material as straight segments of pipe insulation when available.
  - b. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  - c. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- C. Type F Insulation:
- 1. Seal all longitudinal joints with manufacturer approved adhesive or mastic. Secure butt joint strips in a similar manner.
  - 2. Indoors, above grade or below grade, polyvinylidene chloride (PVDC or Saran) vapor retarder film and tape: Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner. Refer to manufacturer's recommendations for installation guidelines.
  - 3. Insulate pipe fittings with prefabricated insulation fittings.

### **3.05 SCHEDULE**

- A. Refer to drawings for insulation schedule.

**END OF SECTION**

## SECTION 22 1000 - PLUMBING PIPING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Check Valves.

#### 1.02 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
- C. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

#### 1.03 REFERENCES

- A. ANSI/ASME A112.3.1 - Stainless Steel Drainage Systems for Sanitary DWV, Storm, and Vacuum Applications, Above and Below Ground.
- B. ASME A112.6.9 - Siphonic Drain Test; The American Society of Mechanical Engineers.
- C. ANSI/ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.
- D. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
- E. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- F. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.
- G. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- H. ANSI/ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- I. ANSI/ASME B31.3 - Chemical Plant and Petroleum Refinery Piping.
- J. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.
- K. ANSI/ASTM B32 - Solder Metal.
- L. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

- M. ANSI/ASTM D2466 - PVC Plastic Pipe Fittings, Schedule 40.
- N. ANSI/AWS D1.1 - Structural Welding Code.
- O. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings 3" through 48", for Water and Other Liquids.
- P. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
- Q. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- R. ANSI/AWWA C153 - Compact Ductile Iron Fittings 3" through 48", for Water and Other Liquids.
- S. ASME - Boiler and Pressure Vessel Code.
- T. ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.
- U. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- V. ASTM A74 - Hub and Spigot Cast Iron Soil Pipe and Fittings.
- W. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- X. ASTM A312 - Standard for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- Y. ASTM A554 - Standard for Welded Stainless Steel Mechanical Tubing.
- Z. ASTM A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
- AA. ASTM A888 - Hubless Cast Iron Soil Pipe and Fittings.
- BB. ASTM B88 - Seamless Copper Water Tube.
- CC. ASTM B306 - Copper Drainage Tube (DWV).
- DD. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- EE. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- FF. ASTM C1540 - Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
- GG. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- HH. ASTM D1785 - Polyvinylchloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- II. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

- JJ. ASTM D2661 - ABS DWV Pipe & Fittings.
- KK. ASTM D2665 - PVC DWV Pipe & Fittings.
- LL. ASTM D2846 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
- MM. ASTM D3033 - Type PSP (Polyvinylchloride) (PVC) Sewer Pipe and Fittings.
- NN. ASTM D3034 - Type PSM (Polyvinylchloride) (PVC) Sewer Pipe and Fittings.
- OO. ASTM F402 - Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
- PP. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
- QQ. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
- RR. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipes.
- SS. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
- TT. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- UU. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
- VV. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.
- WW. AWS A5.8 - Brazed Filler Metal.
- XX. AWWA C651 - Disinfecting Water Mains.
- YY. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- ZZ. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.
- AAA. FM 1680 - Couplings Used in Hubless Cast Iron Systems.
- BBB. NFPA 24 - Private Fire Service Mains and Their Appurtenances.
- CCC. NFPA 54 - National Fuel Gas Code.
- DDD. NFPA 58 - Storage and Handling of Liquefied Petroleum Gases.
- EEE. NSF - National Sanitation Foundation

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store valves in shipping containers with labeling in place.

#### **1.05 COORDINATION DRAWINGS**

- A. Reference Coordination Drawings article in Section 22 0500 for required plumbing systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

### **PART 2 - PRODUCTS**

#### **2.01 COPPER PIPE**

- A. Copper Pipe; Type L; Solder Joints:
  1. Pipe: Type L hard drawn seamless copper tube, ASTM B88.
  2. Design Pressure: 175 psi; Maximum Design Temperature: 200°F.
  3. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
  4. Fittings: Wrought copper solder joint, ANSI B16.22.

#### **2.02 PLASTIC PIPE**

- A. Cross-Linked Polyethylene (PEX); Cold Expansion Joint:
  1. Tubing: Cross-linked polyethylene (PEX-a or PEX-b), SDR-9, ASTM F876, NSF Certified
  2. Design Pressure/Temperature: 100 psig at 180°F.
  3. Joints: Bending the tubing greater than eight (8) times the outside diameter shall be permitted. Bends less than eight (8) times the outside diameter shall be barbed insertion fittings provided by the manufacturer.
  4. Fittings: Cold expansion joint compatible with engineered polymer or lead-free brass construction. System shall conform to ASTM F1960.
  5. Limitations: Shall not be used in a return air plenum unless specifically listed to ASTM E84/UL723.
- B. PVC-DWV Schedule 40; Solvent Weld Joints:
  1. Pipe: Schedule 40 rigid, PVC-DWV, normal impact Type I, with plain ends, conforming to ASTM Standards D2665 . Cellular core piping is not acceptable.
  2. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer.
  3. Fittings: PVC-DWV, normal impact Type I, with solvent-weld socket type ends for Schedule 40 pipe.
  4. Limits: Schedule 40 PVC-DWV, pipe must not be threaded. Do not use where exposed or in return air plenums.
  5. Use: Use PVC only where allowed by local jurisdiction. Comply with all special requirements or limitations.

#### **2.03 VALVES**

- A. Shutoff Valves:

1. For pipe systems where mechanical press connections are allowed, shutoff valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
2. Butterfly Valves:
  - a. BF-1:
    - 1) 2-1/2" thru 6", 175 psi CWP, elastomers rated for 20°F to 250°F at 125 psig, fully lugged end, ductile or cast iron body (not in contact with fluid); bronze, aluminum-bronze or EPDM coated ductile iron disc; EPDM seat, stainless steel stem, extended neck, 175 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to centerline of valve body (for pipe extension without draining system), 10 position locking operator up to 6" size. Cv of at least 1580 in 6" size. Center Line Series 200, Keystone #222, Watts #DBF-03-121-1P, Stockham LD712-B&3-E, Nibco LD2000N Series, Milwaukee CL series, Hammond 5200 series.
    - 2) Mechanically coupled grooved end valves are acceptable if they have the features listed above. Victaulic #608, Nibco GD4765.
3. Ball Valves:
  - a. BA-1: 3" and under, 150 psi saturated steam, 600 psi CWP, full port, screwed or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and trim, Teflon seats and seals. Apollo #77C-140, Stockham #S-255-FB-P-UL, Milwaukee #BA-400, Watts, Nibco #585-70-66, National Utilities Co., RUB.
    - 1) Provide solid extended shaft for all insulated piping.
    - 2) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F, heating water piping over 120°F, steam, condensate, boiler feed water piping, and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.

**B. Throttling Valves**

1. Plug Valves:
  - a. PL-1: 2" and under, 125# steam @ 450°F, 175# CWP @ 180°F, cast iron body, screwed, full port. Walworth #1700, DeZurik #425, S-RS49.
  - b. PL-2: 2-1/2" thru 4", 125# steam @ 450°F, 175# CWP @ 180°F, flanged, cast iron body, full port. Walworth #1700F, DeZurik #425, F-RS49.

**2.04 CHECK VALVES**

- A. For pipe systems where mechanical press connections are allowed, check valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.



- B. CK-1: 2" and under, 125# steam @ 406°F, 200# CWP @ 150°F, screwed, bronze, horizontal swing. Crane #37, Hammond #IB904, Stockham #B319-Y, Walworth #3406, Milwaukee #509, Watts #G-5000, Nibco T-413B.
- C. CK-14: 2-1/2" thru 12", 200# CWP, double disc wafer type, bronze or iron body, bronze trim, metal-to-metal or Viton seat, 316 SS shaft, Inconel 600 spring. Mission Duo Chek #12HPP (with Inconel springs), Mueller Steam Specialty Co. #71-AHB-K-W, Stockham #WG-961-EPDM or #WG-970-BUNA, Nibco w-920-W.

## **2.05 VALVE CONNECTIONS**

- A. Provide all connections to match pipe joints. Valves shall be same size as pipe unless noted otherwise.

## **2.06 CONNECTIONS BETWEEN DISSIMILAR METALS**

- A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.
- B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.
- C. Aluminum, iron, steel, brass, copper, bronze, galvanized steel and stainless steel are commonly used and require isolation from each other with the following exceptions:
  - 1. Iron and steel connected to each other.
  - 2. Brass, copper, and bronze connected to each other.
  - 3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.
- D. Dielectric protection is required at connections to equipment of a material different than the piping.
- E. Screwed Joints (acceptable up to 2" size):
  - 1. Dielectric waterway rated for 300 psi CWP and 225°F.
  - 2. Manufacturers:
    - a. Elster Group ClearFlow fittings
    - b. Victaulic Series 647
    - c. Grinnell Series 407
    - d. Matco-Norca
- F. Flanged Joints (any size):
  - 1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.

2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.
3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.
4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.
5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.
6. Manufacturers:
  - a. EPCO
  - b. Central Plastics
  - c. Pipeline Seal and Insulator
  - d. F. H. Maloney
  - e. Calpico

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Install all products per manufacturer's recommendations.
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Remove scale and dirt, on inside and outside, before assembly.
- D. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.
- E. Connect to equipment with flanges or unions.
- F. Use only piping materials rated for the maximum temperature of the application, e.g., do not use PVC for dishwasher drainage or piping that receives boiler blowdown.
- G. Roof Penetration (Vent) Flashing:
  1. Built-up Roofing: Flash vents with 3# seamless sheet lead of sufficient size to extend 15" into roofing felts for built-up roofs.
- H. Existing building sewers or building drains which are shown on the documents to be reused shall be inspected and recorded by closed circuit television for their condition. Report findings back to the Architect, Engineer, and Owner before proceeding with work so any necessary rework can take place if needed.

### **3.02 SYSTEM, PIPING AND VALVE SCHEDULE**

- A. Cold Water, Hot Water, Tempered Water - Potable and Non-Potable (Above Ground):
  1. Copper Pipe; Type L; Solder Joints: All Sizes
  2. Cross-Linked Polyethylene (PEX); Cold Expansion Joints : 3" and Under
  3. Shutoff Valves:, BA-1
  4. Check Valves: CK-1, CK-14

- B. Sanitary Waste and Vent, Gravity (Above Ground):
  - 1. Copper Pipe; Type DWV; Solder Joints: 1-1/4" to 4"
  - 2. PVC-DWV ; Schedule 40; Solvent Weld Joints: All Sizes
- C. Storm Drainage, Gravity (Above Ground):
  - 1. PVC-DWV ; Schedule 40; Solvent Weld Joints: All Sizes
- D. Sanitary Waste and Vent, Gravity (Underground - Inside Building):
  - 1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
  - 2. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes
- E. Storm Drainage, Gravity (Underground - Inside Building):
  - 1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
  - 2. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes
- F. Kitchen Grease Drainage and Vent (Above Ground):
  - 1. Stainless Steel; Type 316; Hub and Spigot Joint: 2" to 8"
  - 2. Cast Iron; Standard Weight Epoxy Coated; No-Hub Sleeve Gaskets: 1-1/2" to 15"
  - 3. Polyvinyl Chloride (PVC); Schedule 40 Drainage; Solvent Weld Joints
- G. Kitchen Grease Drainage and Vent (Underground):
  - 1. Stainless Steel; Type 316; Hub and Spigot Joint: 2" to 8"
  - 2. Cast Iron; Standard Weight Epoxy Coated; No-Hub Sleeve Gaskets: 1-1/2" to 15"
  - 3. Polyvinyl Chloride (PVC); Schedule 40 Drainage; Solvent Weld Joints

### **3.03 TESTING PIPING**

- A. Sanitary Drainage, Sanitary Vent, Storm Drainage:
  - 1. Test all piping with water to prove tight.
  - 2. Test piping before insulation is applied.
  - 3. Hydrostatically test all soil, waste, and vent piping inside of building with 10 feet head of water for 15 minutes. Inspect before fixtures are connected. If leaks appear, repair them and repeat the test.
  - 4. Hydrostatically test interior downspouts with 10 feet head of water for 15 minutes with no leaks.
  - 5. A smoke/air test at the same pressure may be used in lieu of the hydrostatic water test. Exception: Smoke/air test shall not be performed on plastic piping.
  - 6. Test force mains with water at 105% of the operating pump discharge pressure for 15 minutes.
  - 7. Test pressures stated above shall be as listed or as required by the Authority Having Jurisdiction, whichever is most stringent.
- B. Hot Water - Potable and Non-Potable, Cold Water - Potable and Non-Potable:
  - 1. Test pipes underground or in chases and walls before piping is concealed.

2. Test all pipes before the insulation is applied. If insulation is applied before the pipe is tested and a leak develops which ruins the insulation, replace damaged insulation.
3. Test the pipe with 100 psig water pressure or equal inert gas such as nitrogen. Exception: Inert gas test shall not be used to test plastic piping.
4. Hold test pressure for at least 2 hours.
5. Test to be witnessed by the Architect/Engineer's representative, if requested by the Architect/Engineer.

C. All Other Piping:

1. Test piping at 150% of normal operating pressure.
2. Piping shall hold this pressure for one hour with no drop in pressure.
3. Test piping using water, nitrogen, or air as compatible with the final service of the pipe. Do not use combustible fluids.
4. Drain and clean all piping after testing is complete.

### 3.04 CLEANING PIPING

A. Assembly:

1. Before assembling pipe systems, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer's representative. Blow chips and burrs from machinery or thread cutting operation out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing.
3. Notify the Architect/Engineer's representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Architect/Engineer's representative regarding specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.
4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.

B. All Water Piping:

1. Flush all piping using faucets, flush valves, etc. until the flow is clean.
2. After flushing, thoroughly clean all inlet strainers, aerators, and other such devices.
3. If necessary, remove valves to clean out all foreign material.

### 3.05 INSTALLATION

A. General Installation Requirements:

1. Provide dielectric connections between dissimilar metals.
2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
3. Group piping whenever practical at common elevations.
4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
5. Slope water piping and arrange to drain at low points.
6. Install bell and spigot piping with bells upstream.
7. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

8. Seal pipes passing through exterior walls with a wall seal per Section 22 0529. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
9. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.
10. All vertical pipe drops to sinks or other equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted. For renovation projects, this Contractor is responsible for opening and patching existing walls for installation of piping. Wall patching shall match existing condition.

B. Installation Requirements in Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.

C. Valves/Fittings and Accessories:

1. Install shutoff valves that permit the isolation of equipment/fixtures in each room without isolating any other room or portion of the building. Individual fixture angle stops do not meet this requirement. Exception: Back-to-back rooms in no more than two adjacent rooms.
2. Provide clearance for installation of insulation and access to valves and fittings.
3. Provide access doors for concealed valves and fittings.
4. Install valve stems upright or horizontal, not inverted.
5. Provide one plug valve wrench for every ten plug valves 2" and smaller, minimum of one. Provide each plug valve 2-1/2" and larger with a wrench with set screw.
6. Install corrugated, stainless steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.

D. Underground Piping:

1. Install buried water piping outside the building with at least 5 feet of cover. Refer to Section 22 0500 for Excavation, Fill, Backfill and Compaction requirements
2. Install buried borosilicate glass pipe with the protective polystyrene covering intact. Lay the pipe on bedding and backfill per manufacturer instructions.

E. Sanitary and Storm Piping:

1. Install all sanitary and storm piping inside the building with a slope as shown on the drawings.
2. Install horizontal offset at all connections to roof drains to allow for pipe expansion.
3. Slope sanitary and storm piping outside the building to meet invert elevations shown on drawings and to maintain a minimum velocity of 2 feet per second.
4. Sway Bracing: Where horizontal sanitary and/or storm pipes 4 inches and larger change flow direction greater than 45°, rigid bracing or thrust restraints shall be installed to resist movement of the upstream pipe in the direction of pipe flow. The rigid bracing or thrust restraint shall be connected to structure. A change of flow direction from horizontal into a vertical pipe does not require the upstream pipe to be braced.

### **3.06 PIPE ERECTION AND LAYING**

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.
- B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not install any item that is not clean.
- D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.
- E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.
- F. Make changes in direction of pipes only with fittings or pipe bends. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.
- G. Provide flanges or unions at all final connections to equipment, traps and valves.
- H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.
- I. Use full and double lengths of pipe wherever possible.
- J. Unless otherwise indicated, install all piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at control valve or equipment.
- K. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.
- L. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Refer to Section 22 0500 for Excavation, Fill, Backfill and Compaction requirements.
- M. Unless otherwise indicated, branch take-offs shall be from top of mains or headers at either a 45° or 90° angle from the horizontal plane for air lines, and from top, bottom or side for liquids.
- N. Do not use geotextile fabric with footing tile if silt content of soil exceeds 40% or if clay content exceeds 50%. The fabric shall be installed around 1" river rock or 2" limestone.

### **3.07 DRAINING AND VENTING**

- A. Unless otherwise indicated on the drawings, all horizontal water lines, including branches, shall pitch 1" in 40 feet to low points for complete drainage, removal of condensate and venting.
- B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.
- C. Provide drain valves at all low points of water piping systems for complete or sectionalized draining.
- D. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.
- E. Provide air vents at high points and wherever else required to eliminate air in all water piping systems.
- F. Install air vents in accessible locations. If necessary to trap and vent air in a remote location, install an 1/8" pipe from the tapping location to an accessible location and terminate with a venting device.
- G. All vent and drain piping shall be of same materials and construction for the service involved.

### **3.08 PLUMBING VENTS**

- A. Vent as shown on the drawings and in accordance with all codes having jurisdiction.
- B. Extend the high side of the soil and waste stacks at least 12" above roof.
- C. Flash pipes at roof with premolded EPDM pipe flashing cones adhered to roof membrane by General Contractor. Secure top of cone with stainless steel clamp and seal watertight.
- D. Increase vent pipes through the roof two pipe sizes with long increasers located at least 12" below the roof.
- E. Vent pipes through the roof shall be located a minimum of 10 feet from any air intake opening on the roof.

### **3.09 BRANCH CONNECTIONS**

- A. For domestic water and vent systems only, make branch connections with standard tee or cross fittings of the type required for the service.
- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. Do not use double wye or double combination wye and eighth bend DWV fittings in horizontal piping.

- D. Branch connections from the headers and mains may be mechanically formed using an extraction device. The branch piping connection shall be brazed connection for the following services only:

- 1. Domestic water piping above ground.

### **3.10 JOINING OF PIPE**

- A. Solder Joints (Copper Pipe):

- 1. Make up joints with 100% lead-free solder, ASTM B32. Cut tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to soldering. Apply flux evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly so solder will flow to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.
- 2. Flux shall be non-acid type.
- 3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470°F melting point solder. Remove discs and seals during soldering if they are not suitable for 470°F.

- B. Brazed Joints (Copper Pipe):

- 1. Make up joints with silver alloy brazing filler metal conforming to ASTM B260 "Brazing Filler Metal" BAg-1 or BAg-2. Cut copper tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to brazing. Apply non-corrosive flux of the type recommended by filler alloy manufacturer, evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly using oxygen-acetylene torch with tip size recommended by fitting manufacturer. Wipe and brush joint clean after alloy has set.

- C. Solvent Weld Joints (PVC):

- 1. Make joints with a two-step process. Use primer conforming to ASTM F656 and solvent cement conforming to ASTM D2564.

- D. Cold Expansion Joint (PEX):

- 1. Cold expansion joints shall be made in accordance with manufacturer's installation instructions.
- 2. All installers shall undergo training provided by the manufacturer or manufacturer's representative.

### **3.11 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM**

- A. Disinfection of the domestic water piping shall be completed within three (3) weeks prior to building occupancy. Contractor is responsible for disinfecting water piping if used by workers during construction; disinfection during construction does not eliminate the requirement for final disinfection prior to occupancy. Flushing of piping shall be completed within two (2) weeks prior to building occupancy.



- B. Provide necessary connections at the start of individual sections of mains for adding chlorine.
- C. Before starting work, verify system is complete, flushed and clean.
- D. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- E. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- F. Bleed water from all outlets to ensure chlorine distribution throughout the entire domestic water system.
- G. Verify initial chlorination levels by testing at minimum 15% of outlets located throughout entire building, including the last fixture connected to each main and each branch extending over 50 feet from a main.
- H. Maintain disinfectant in system for 24 hours, after which test at minimum 15% of outlets located throughout entire building, including the last fixture connected to each main and each branch extending over 50 feet from a main. If final disinfectant residual tests less than 25 mg/L at any one of the tested outlets, flush the entire system and repeat disinfection and testing procedure.
- I. After final disinfectant residuals test at or above 25 mg/L after a minimum 24-hour duration, flush disinfectant from system at a minimum velocity of 3.0 feet/second until residual is equal to that of incoming water or 1.0 mg/L.
- J. Take water samples, no sooner than 24 hours after flushing, from 2% of outlets and from water entry. Obtain, analyze, and test samples in accordance with AWWA C651, Section 5 - Verification.

**END OF SECTION**

## SECTION 22 1023 - NATURAL GAS PIPING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Natural Gas Piping System.

#### 1.02 REFERENCES

- A. ANSI/AWS D1.1 - Structural Welding Code.
- B. ANSI AGA-LC1 - Standards for Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing.
- C. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
- D. ASME - Boiler and Pressure Vessel Code - Section 9.
- E. ASME B1.20.1 - Pipe Threads, General Purpose.
- F. ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.
- G. ASME B16.5 - Pipe Flanges and Flanged Fittings.
- H. ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- I. ASME B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.
- J. ASME B16.21 - Nonmetallic Flat Gaskets for Pipes Flanges.
- K. ASME B16.39 - Malleable Iron Threaded Pipe Unions.
- L. ASME B18.2.1 - Square and Hex Bolts and Screws, Inch Series.
- M. ASME B18.2.2 - Square and Hex Nuts, Inch Series.
- N. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- O. ASTM A105 - Standard Specification for Carbon Steel Forgings for Piping Applications.
- P. ASTM A181 - Forgings, Carbon Steel for General Purpose Piping.
- Q. ASTM A197 - Standard Specification for Cupola Malleable Iron.
- R. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

- S. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- T. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- U. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
- V. ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe.
- W. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
- X. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- Y. NFPA 54 - National Fuel Gas Code.

### **1.03 SUBMITTALS**

- A. Submit product data under provisions of Section 22 05 00. Include data on pipe materials, fittings, valves, and accessories.
- B. Test Reports: Provide results of piping system pressure test.
- C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Store and protect piping to prevent entrance of foreign matter into pipe and to prevent exterior corrosion.
- B. Deliver and store valves in shipping containers with labeling in place.

### **1.05 COORDINATION DRAWINGS**

- A. Reference Coordination Drawings article in Section 22 05 00 for the required natural gas piping system electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

## **PART 2 - PRODUCTS**

### **2.01 NATURAL GAS (0 to 125 PSI)**

- A. Piping - 2" and Under:
  1. Pipe: Standard weight steel, threaded and coupled, ASTM A53.
  2. Joints: Screwed. (NOTE: For below ground, all sizes to have welded joints.)
  3. Fittings: 150# steam - 300# CWP, black malleable iron, banded, ASTM A197, ANSI B16.3.

4. Unions: 250# - 500# CWP, black malleable iron, ANSI B16.39, ground joint with brass seat.
- B. Piping - 2-1/2" and Over:
1. Pipe: Standard weight steel, beveled ends, ASTM A53.
  2. Joints: Butt welded or flanged.
  3. Fittings: Standard weight seamless steel, butt weld type, ASTM A234, Grade I, ANSI B16.9.
  4. Flanges: 150# forged steel, weld neck or slip-on, ASTM A181, Grade I, ANSI B16.5. Flange face seal weld (backweld) is required for slip-on flanges.
- C. Shutoff Valves/Throttling Valves:
1. BA-13: 2" and under, threaded 600 psi CWP; UL listed for 250# LP, flammable liquid, heating oil, natural and manufactured gases, 150 psi steam, bronze body and chrome plated brass ball, Teflon seats and packing.
    - a. Manufacturers:
      - 1) Apollo #80-100
      - 2) Nibco #T580-70-UL or #T585-70-UL
      - 3) Watts #B-6000
  2. PL-1: 2" and under, 125# steam @ 450°F, 175# CWP @ 180°F, cast iron body, screwed, full port.
    - a. Manufacturers:
      - 1) Walworth #1700
      - 2) DeZurik #425, S-RS49
  3. PL-2: 2-1/2" thru 4", 125# steam @ 450°F, 175# CWP @ 180°F, flanged, cast iron body, full port.
    - a. Manufacturers:
      - 1) Walworth #1700F
      - 2) DeZurik #425, F-RS49

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Ream pipe and tube ends, remove burrs, bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.
- D. Connect to all equipment with flanges or unions.

- E. After completion, fill, clean, and treat systems. Refer to Section 23 2500 for treatment.

### **3.02 TESTING PIPING**

- A. Low Pressure - Up to 1 psi:
  - 1. Test piping with 20 psi air pressure. System must hold this pressure without adding air for two hours.
- B. High Pressure - Above 1 psi:
  - 1. Test piping with compressed air at twice the operating gas pressure, but at least 20 psi. System must hold this pressure without adding air for two hours.
- C. A non-combustible odorant, such as oil of wintergreen, may be added to help locate leaks.

### **3.03 CLEANING PIPING**

- A. Assembly:
  - 1. Prior to assembly of pipe and piping components, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer. Blow chips and burrs out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
  - 2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing to the degree consistent with good piping practices.
  - 3. Notify the Architect/Engineer prior to starting any post erection cleaning operation in time to allow witnessing the operation. Properly dispose of cleaning and flushing fluids.
  - 4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, control valves, and balance valves, and verify all strainer screens are in place.

### **3.04 INSTALLATION**

- A. Route piping in orderly manner, straight, plumb, with consistent pitch, parallel to building structure, with minimum use of offsets and couplings. Provide only offsets required for needed headroom or clearance and needed flexibility in pipe system.
- B. Install piping to conserve building space, and not interfere with other work.
- C. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Install thrust blocking and restraints on all buried piping at elbows and other changes in pipe direction.

- G. Provide chain operators for all valves over 2" size that are over 10'-0" above finished floor. Extend to 7'-0" above finished floor.
- H. Provide valve position indicator on all valves 10'-0" or greater above finish floor and not located above ceiling.
- I. Provide clearance for access to valves and fittings.
- J. Provide access doors where valves are not exposed.
- K. Prepare pipe, fittings, supports, and accessories for finish painting.
- L. Install valves with stems upright or horizontal, not inverted.
- M. Arrange piping and piping connections so equipment may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.
- N. Reducers are generally not shown. Where pipe sizes are not shown, the larger size in either direction shall continue through the fitting nearest to the indication of a smaller pipe size.
- O. Seal pipes passing through exterior walls with a wall seal per Section 23 0529. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
- P. Refer to Section 23 0500 for Excavation, Fill, Backfill and Compaction requirements.
- Q. All vertical pipe drops to equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted. For renovation projects, this Contractor is responsible for opening and patching existing walls for installation of piping. Wall patching shall match existing condition.
- R. Install corrugated, stainless steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.

### **3.05 BONDING AND GROUNDING**

- A. Each above ground portion of a corrugated stainless steel tubing gas piping systems shall be bonded to the electrical service grounding electrode system. The bonding jumper shall connect to a metallic pipe or fitting between the point of delivery and the first downstream corrugated stainless steel tube fitting. The bonding jumper shall not be smaller than 6 AWG copper wire or equivalent. Gas piping systems that contain one or more segments of corrugated stainless steel tubing shall be bonded in accordance with this section.
- B. Each above ground portion of a gas piping system, other than corrugated stainless steel tubing systems, that is likely to become energized shall be electrically continuous and bonded to an effective ground-fault current path. Gas piping, other than corrugated stainless steel tubing, shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance.
- C. Gas piping shall not be used as a grounding conductor or electrode.

- D. Where a lightning protection system is installed, the bonding of the gas piping shall be in accordance with NFPA 780, Standard for the Installation of Lightning Protection Systems.

### **3.06 PIPE ERECTION AND LAYING**

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories prior to installation. Immediately reject and remove from the job any items which are unsuitable, cracked or otherwise defective.
- B. All pipe, fittings, valves, equipment and accessories shall have factory-applied markings, stampings, or nameplates sufficient to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any unclean item.
- D. During construction, until system is fully operational, keep all openings in piping and equipment closed at all times except when actual work is being performed on that item. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.
- E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be long radius type, unless otherwise shown on the drawings or specified. Construct welded elbows of angles not available as standard fittings by cutting and welding standard elbows to form smooth, long radius fittings.
- F. Use full and double lengths of pipe wherever possible.
- G. Cut all pipe to exact measurement and install without springing or forcing.
- H. Do not create, even temporarily, undue loads, forces or strains on valves, equipment or building elements.

### **3.07 DRAINING AND VENTING**

- A. Unless otherwise indicated on the drawings, all horizontal pipes, including branches, shall pitch 1" in 40 feet to low points for complete drainage.
- B. Use eccentric reducing fittings on horizontal runs when changing size for proper drainage and venting. Install gas pipes with bottom of pipe and eccentric reducers in a continuous line.
- C. Provide drip legs at low points and at the base of all risers in gas pipes. Drip legs shall be full line size on pipes through 4" and at least 4", but not less than half line size over 4". Drip legs shall be 12" minimum length, capped with a reducer to a drain valve.

### **3.08 BRANCH CONNECTIONS**

- A. Make branch connections with standard tee or cross fittings of the type required for the service unless otherwise specified herein or detailed on the drawings.

- B. At the option of the Contractor, branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.
- C. Use of forged weld-on fittings is also limited as follows:
  - 1. Must have at least same pressure rating as the main.
  - 2. Header or main must be 2-1/2" or over.
  - 3. Branch line is at least two pipe sizes under header or main size.
- D. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- E. All branch piping connections for natural gas shall take off on the top or on the side of the main.

### **3.09 JOINING OF PIPE**

- A. Threaded Joints:
  - 1. Ream pipe ends and remove all burrs and chips.
  - 2. Protect plated pipe and valve bodies from wrench marks when making up joints.
  - 3. Apply gas-rated Teflon tape or thread compound to male threads.
- B. Flanged Joints:
  - 1. Steel flanges shall be raised face.
  - 2. Bolting for services up to 500°F shall be ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B18.2.2 "Square and Hex Nuts".
  - 3. Torque bolts in at least three passes, tightening to 1/3, 2/3, and final torque in a cross pattern with an indicating torque wrench for equal tension in all bolts.
  - 4. Gaskets for flat face flanges shall be full face type. Gaskets for raised faced flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Unless otherwise specified gaskets shall meet the following requirements:
    - a. Gasket material and thickness approved by manufacturer for intended service, chemical compatibility, pipe system test pressure, and operating temperature range.
    - b. Maximum pressure rating of at least 250 psig.
    - c. Minimum temperature rating: -10°F.
    - d. Maximum temperature rating of at least 170°F for water systems operating 140°F and less.
- C. Welded Joints:
  - 1. Welding of all pipe joints, both as to procedures and qualification of welders, shall be in accordance with Section IX, ASME "Boiler & Pressure Vessel Code" unless local codes take precedence.
  - 2. Furnish certificates qualifying each welder to the Owner's Representative prior to start of work.
  - 3. The Owner's Representative reserves the right to require qualifying demonstration, at the Contractor's expense, of any welders assigned to the job.



4. Ends of pipe and fittings to be joined by butt-welding shall be beveled, cleaned to bare metal and internal diameters aligned before tack welding.

**3.10 SERVICE CONNECTIONS**

- A. Provide new gas service complete with gas meter and regulators. Verify gas service pressure with the Utility Company.

**END OF SECTION**

## **SECTION 22 1030 - PLUMBING SPECIALTIES**

### **PART 1 - GENERAL**

#### **1.01 REFERENCES**

- A. ANSI A112.21.1 - Floor Drains.
- B. ANSI A112.21.2 - Roof Drains.
- C. ASSE 1010 - Water Hammer Arresters.
- D. ANSI A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers.
- E. ANSI A112.6.4 - Roof, Deck, and Balcony Drains; The American Society of Mechanical Engineers.
- F. ASME A112.6.9 - Siphonic Drain Test; The American Society of Mechanical Engineers.
- G. ANSI 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering.
- H. ANSI 1012 - Backflow Preventer with Intermediate Atmospheric Vent; American Society of Sanitary Engineering.
- I. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers; American Society of Sanitary Engineering; 1.
- J. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering.
- K. ASSE 1047 - Reduced Pressure Detector Assemblies.
- L. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- M. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
- N. PDI WH-201 - Water Hammer Arresters.

### **PART 2 - PRODUCTS**

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION AND APPLICATION**

- A. Coordinate construction to receive drains at required invert elevations.
- B. Install all items per manufacturer's instructions.

**END OF SECTION**

## SECTION 22 1123 - DOMESTIC WATER PUMPS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Domestic Water In-Line Circulators.

#### 1.02 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 0500.
- B. Submit certified pump performance curves with pump and system operating point plotted. Include NPSH curve when applicable.
- C. Pumps with motors operating above the RPM the pump curves are based on shall have impellers trimmed to deliver GPM and head scheduled.
- D. Manufacturer shall provide special seismic certification per HCAI CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

### PART 2 - PRODUCTS

#### 2.01 GENERAL

- A. Statically and dynamically balance rotating parts.
- B. Construction shall permit complete servicing without breaking piping or motor connections.
- C. Pumps shall operate at 1750 rpm unless specified otherwise.
- D. Pump connections shall be flanged, whenever available.
- E. Domestic hot water pumps shall be suitable for 225°F water.
- F. Motors shall comply with Section 22 0513.
- G. Submitted pump selections must have a diameter impeller that meets or exceeds the scheduled pump. The inlet and discharge pipe sizes shall also meet or exceed the scheduled pump.

#### 2.02 DOMESTIC WATER IN-LINE CIRCULATORS

- A. Provide pumps as specified on the drawings.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. General Installation Requirements:

1. Install all products per manufacturer's recommendations.
2. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

B. In-Line Pump:

1. Support in-line pumps individually so there is no strain on the piping. Support pump so no weight is carried on pump casings. Install with a minimum of five diameters of straight pipe on pump suction and discharge.
2. Ensure pumps operate at specified fluid temperatures without vapor binding or cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.
3. Pumps shall be factory aligned. If alignment is not satisfactory, as determined by the Architect/Engineer, manufacturer shall provide a factory trained representative to field align the shafts.
4. Alignment shall be inspected and approved by a factory trained representative. If alignment is not satisfactory, representative shall field align this shaft.

C. Pump without VFD or ECM:

1. For pumps not powered by a VFD, trim impeller to meet maximum operating conditions. Coordinate final trimmed diameter with Testing, Adjusting, and Balancing Contractor and Architect/Engineer.

**END OF SECTION**

## SECTION 22 1429 - SUMP PUMPS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Sump Pumps.

#### 1.02 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 0500.
- B. Submit certified pump performance curves with pump and system operating point plotted. Include NPSH curve when applicable.
- C. Pumps with motors operating above the RPM the pump curves are based on shall have impellers trimmed to deliver GPM and head scheduled.
- D. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

### PART 2 - PRODUCTS

#### 2.01 GENERAL

- A. Statically and dynamically balance rotating parts.
- B. Construction shall permit complete servicing without breaking piping or motor connections.
- C. Pumps shall operate at 1750 rpm unless specified otherwise.
- D. Pump connections shall be flanged, whenever available.
- E. Motors shall comply with Section 22 0513.
- F. The discharge pipe sizes shall meet or exceed the scheduled pump.

#### 2.02 SUMP PUMPS

- A. Provide pumps as specified on the drawings.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Install pumps and arrange to provide access for maintenance including removal of motors, impellers, couplings and accessories.

- C. Support piping so weight of piping is not supported by pumps.
- D. Mount control panel on adjacent wall within required distance for cables and wiring. Provide unistrut mounting frame for the control panel if wall space is not available. Properly anchor frame to floor.
- E. Ensure pumps operate at specified fluid temperatures without vapor binding or cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.
- F. Pumps shall be factory aligned. If alignment is not satisfactory, as determined by the Architect/Engineer, manufacturer shall provide a factory trained representative to field align the shafts.

**END OF SECTION**

## SECTION 22 3000 - PLUMBING EQUIPMENT

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Water Heaters.
- B. Water Softeners.
- C. Pressure Booster System.

#### 1.02 QUALITY ASSURANCE

- A. Products and installation of specified products shall conform to recommendations and requirements of the following organizations:
  - 1. American Gas Association (AGA).
  - 2. National Sanitation Foundation (NSF).
  - 3. American Society of Mechanical Engineers (ASME).
  - 4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
  - 5. National Electrical Manufacturers' Association (NEMA).
  - 6. Underwriters' Laboratories (UL).

#### 1.03 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASME Section 8D - Pressure Vessels.
- C. ANSI Section 21.10.1 or Section ANSI 21.10.3 - Gas Water Heaters Ratings 75,000 BTU per Hour and Less.
- D. ANSI/NFPA 30 - Flammable and Combustible Liquids Code.
- E. ANSI/NFPA 54 - National Fuel Gas Code.
- F. ANSI/NFPA 70 - National Electrical Code.
- G. ANSI/UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.
- H. ASSE 1005 - Water Heater Drain Valves, 3/4" Iron Pipe Size.
- I. UL 174 - Household Electric Storage Tank Water Heaters.

#### 1.04 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 0500.



- B. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
- C. Include heat exchanger dimensions, size of tappings, and performance data.
- D. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.
- E. For equipment connected to an electric power source, submit short circuit rating (SCCR) of integrated unit.
- F. Submit manufacturer's installation instructions including control and electrical power/controls wiring diagrams.
- G. Submit manufacturer's certificate that pressure vessels meet or exceed specified requirements.
- H. Submit operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- I. Submit a current water analysis from the actual water source serving the project site for softening equipment verification before sending shop drawings to the Architect/Engineer.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

#### **1.06 REGULATORY REQUIREMENTS**

- A. Water heaters shall conform to AGA, ANSI/NFPA 54, ANSI/NFPA 70, ANSI/UL 1453 as applicable.
- B. Conform to ANSI/ASME Section 8 Division 1 for fabrication of steel pressure vessels.
- C. Conform to ANSI/ASME Section 10 for manufacture of fiber-reinforced plastic pressure vessels.

### **PART 2 - PRODUCTS**

#### **2.01 WATER HEATERS**

- A. All water heaters shall be as scheduled on the drawings.

#### **2.02 COMMERCIAL WATER SOFTENER**

- A. All water softeners shall be as scheduled on the drawings.
- B. Automatic softener to remove hardness to no more than 1.0 grains per gallon as determined by an ASTM Standard Soap Test Method.

- C. Incoming water contains approximately 20 grains per gallon based on information obtained from the internet. Obtain a current water sample from the water source that will be serving the project and have it analyzed to make sure equipment can perform as designed. Provide report to the Architect/Engineer before providing shop drawings.
- D. Softener Tank: Fiberglass reinforced polyester, ASME stamped, designed for a minimum working pressure of 100 psig, hydrostatically tested at 150% of working pressure. side shell height to allow a minimum freeboard space of 50% of the mineral bed depth for adequate expansion during backwashing. Tank bottom will be supported with a molded structural base.
- E. Distribution System: Soft water collector and backwash distributor, hub and arm radial or healer lateral type lower distribution system. Distribution shall be covered with a single layer of washed inorganic media to evenly distribute the service and backwash water and support the mineral bed tank.
- F. Brine Tank: Rigid polyethylene or fiberglass with tight fitting cover, corrosion-free elevated salt platform, float-operated plastic fitted brine valve to control brine withdrawal and freshwater refill. The brine valve shall provide positive shutoff to prevent air from entering the system. Brine eductor shall dilute brine flow to softener. Brine shall be provided with a float-operated shutoff valve to keep the tank from overflowing.
  - 1. Provide initial fill of brine tank with manufacturer recommended salt product. Tank shall be full at time the Owner is given occupancy.
- G. Softener Ion Exchange Resin: Virgin, high capacity, standard mesh of sulfonated polystyrene type stable over the entire PH range, with good resistance to bead fracture from attrition or osmotic shock. Minimum exchange capacity of 30,000 grains when regenerated with 15 lbs. of salt per cubic foot. Solid resin, of the proper particle size of 20 to 50 mesh, U.S. standard screen, and will contain no agglomerates, shells, plates, or other shapes to interfere with normal function of water softener.
- H. Pipes, Valves and Fittings: Pipe shall be Type L copper. Fittings shall be Type L for copper, and Schedule 5 for stainless steel. All piping shipped assembled shall be hydrostatically tested for leaks at the factory.
- I. Water Testing Equipment: Complete with sample cock installed to obtain samples of effluent water. Furnish a complete test kit for conducting soap tests.
- J. Automatic Controls:
  - 1. The main control shall be a fully automatic, top-mounted brass control. . The top-mounted main control design will be motor driven, mechanically activated, with five pistons to accomplish the regeneration steps of backwash, brine draw/rinse, fast rinse, and brine refill, in addition to the service position.
  - 2. The main control shall incorporate self-adjusting flow regulators to control the rate of flow and prevent resin loss during backwash, regardless of the system pressure fluctuations between 30 and 120 psig.
  - 3. Valves shall be controlled by integral electronic controls. Controls shall display status of each unit with respect to service and regeneration. Controls for multi-tank systems shall be capable of operating units simultaneously, alternating unit service, or progressively bringing additional units on and off line as needed to maintain flow rates and reduce risk of channeling.

4. Regeneration shall be initiated by volume. System shall be programmed so units are unable to regenerate simultaneously.
5. Electrical Requirements: Each valve shall be prewired with a plug and cord and an inline breaker to plug into a standard receptacle or wired to a common control panel so a single electrical connection can be provided. 120 volt-single phase. Electric power shall not be needed for manual regeneration. Inlet hydraulic pressure shall be required.

K. Extra Stock:

1. Furnish extra materials as listed below that match products installed and that are packaged and labeled for storage.
  - a. Provide 200 lbs. additional salt in the same form as the original load. Salt shall be delivered and stored on pallet(s). Locate the pallet(s) per the Owner's direction.
  - b. Provide one additional gasket for each handhole and manway.

L. Warranty:

1. Provide a standard one-year warranty on the entire unit from the date of final acceptance.
2. Provide a standard two-year warranty on the control valve internal parts, the brine valve and associated parts, and the salt storage container internal components.
3. Provide a standard five-year warranty on the control valve body, fiberglass wound container(s) (if applicable), salt storage container(s) (if applicable), and epoxy lined steel conditioner tank(s) (if applicable).

M. Manufacturers:

1. Culligan
2. Marlo
3. Hellenbrand
4. Diamond
5. Siemens
6. Watts
7. Sterling
8. Avid
9. Water Control

**2.03 PRESSURE BOOSTER SYSTEMS**

- A. Packaged pressure boosting system shall be completely factory assembled, run-tested, and shipped to site as an integral unit assembled on a steel skid including pumps, motors, valves, stainless steel suction and discharge manifolds, all interconnecting piping, wiring, variable frequency drives with Logic and power controls. Size and capacity shall be as scheduled on the drawings.
- B. Shutoff valves shall be provided on the suction and discharge of each pump. Silent spring-loaded check valves shall be installed on the discharge of each pump.

- C. Pressure gauges shall be provided on the front cover of the control panel indicating system suction and discharge pressure. Pressure gauges shall be 4-1/2 inch diameter, Grade 1A, having 1% total range span accuracy and installed with shutoff valve and pressure snubber at gauge connection to system piping. All skid-mounted components shall be factory finished with enamel paint. Individual pumps, motors, variable frequency drives, and check valves shall be serviceable with the booster system in operation, and all components shall be suitable for the maximum system working pressure.
- D. System shall include three mounted pumps with ANSI flanged or NPT threaded connections, replaceable casing wear rings, and hydraulically balanced impellers. Pumps shall be cast iron, bronze or stainless steel fitted construction with replaceable shaft sleeves and mechanical seals suitable for 175 psig working pressure.
- E. Pressure regulating valves to control system pressure at the unit are not allowed per ASHRAE 90.1.
- F. Each pump shall include a pressure relief valve, set to relieve 15 psi above the high limit pressure switch setting, which shall be piped to a floor drain by the installing contractor.
- G. Provide each pump with a premium efficient open drip-proof motor labeled for use with variable frequency drives (VFDs) and sized for operation at any point of the pump curve, including pump run-out (non-overloading operation).
- H. Provide and mount on the system skid one two three four VFDs suitable for variable torque applications. Minimum acceptable VFD full load/full speed efficiency shall be 97%, with a fundamental power factor of 0.98. VFDs shall meet the following:
  - 1. Pulse width modulated (PWM).
  - 2. Starts into rotating load.
  - 3. Overcurrent protection.
  - 4. Adjustable carrier switching frequency of up to 8 kHz.
  - 5. Keypad operator device or touchscreen that includes the following:
    - a. 2-line backlit display.
    - b. Power on and alarm/fault indicators
    - c. Hand-Off-Auto switch on VFD front panel cover
    - d. When switched to "Auto" operation, the VFDs shall follow the signal from the control panel logic section.
    - e. When switched to "Hand", the VFD speed is determined by the setting of the manual speed adjustment located on the VFD front panel cover.
    - f. Automatic VFD shutdown for electrical fault
    - g. Automatic restart after electrical power is restored from a loss of power
    - h. Service diagnostics with fault history log.
- I. Provide a high limit pressure switch compatible with the system controls, temperature, and pressure requirements. The pressure switch shall be mounted and wired on the control panel, with sensing line connected to the system discharge manifold. The high limit pressure switch shall shut down the system if the system pressure is more than 30 psi above the normal operating pressure.
- J. Provide a pressure sensor/transmitter, shipped loose for field installation, that provides a modulating output compatible with the system controls. The pressure sensor/transmitter shall be used to control booster pump VFDs to maintain a constant system pressure.

- K. Provide a factory-mounted pressure sensor/transmitter in the discharge header that provides a modulating output compatible with the system controls. The pressure sensor/transmitter shall be used to control booster pump VFDs to maintain a constant system pressure. Control logic shall be capable of adjusting the pressure setpoint using a system pressure drop algorithm based on real-time flow data.
- L. Use of a single pressure sensor/transmitter to control system pressure and high limit pressure cutoff is not acceptable. Both the high limit pressure switch and the pressure sensor/transmitter shall be separately wired back to the booster pump control panel.
- M. The lead pump shall run only as necessary to maintain system pressure and will be automatically controlled by means of a pressure sensor/transmitter and control programming to prevent short cycling.
- N. If the lead pump is unable to maintain system pressure at the pressure sensor/transmitter, the lag pump will be called on after a time delay and will operate in parallel with the lead pump in accordance with control programming. When a low or no-flow condition is reached, the controls will shut down the lag pump if running and accelerate the lead pump to charge the system and hydro-pneumatic tank to 20 psi above normal operating pressure, then shut the lead pump down and alternate. Should any pump fail to operate, the next pump in sequence shall start automatically.
- O. Provide, mount and wire on the skid a programmable logic controller in a NEMA 1 enclosure. The controller shall interface the signals from the sensors to the VFDs and shall provide a stabilized response to speed up or slow down the pump or add additional pumps to meet system requirements. The controller shall provide setpoint control that can be changed by a keypad entry on the control faceplate. The controller shall have an alpha/numeric display, PID functions and both system and controller self-diagnostics. Controller shall be provided with dual function PID loop for startup mode and normal operation. Startup mode shall provide a quick response from shutdown and normal operation is tuned to eliminate hunting. Controller shall have a real-time calendar/clock and memory transfer cartridge.
- P. Provide a UL listed control panel in a NEMA 3R enclosure, factory mounted and wired on the steel skid. The panel shall be furnished with individual pump disconnects with through-the-door handles, pump run lights, H-O-A selector switches, 120-volt fused control transformer, and necessary relays, timers and a programmable controller with pump start, stop and sequence controls.
- Q. The controller shall be capable of outputting system pressure and a general alarm signal to the building automation system.
- R. Non-mercury low pressure control to stop pump operation if incoming water pressure drops to atmospheric.
- S. Size and capacity shall be as scheduled on the drawings.
- T. Manufacturers:
  - 1. Xylem B&G
  - 2. Grundfos
  - 3. Goulds
  - 4. Metropolitan
  - 5. HYFAB

6. QuantumFlo
7. Delta P Carver
8. or approved equivalent

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install all items in accordance with manufacturer's instructions.

#### **3.02 WATER HEATER INSTALLATION**

- A. Install water heaters on concrete bases. Coordinate sizes and locations of concrete bases. Refer to Section 22 0529.
- B. Install water heaters level and plumb, according to drawings, manufacturer's instructions, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend drain piping full size from relief valve and discharge by positive air gap onto closest floor drain. Discharge pipe material shall be same as domestic water piping.
- D. Install gas water heaters according to NFPA 54.

#### **3.03 WATER SOFTENER INSTALLATION**

- A. Verify connection sizes and piping type with cold water and soft cold water piping. Provide dielectric connection between dissimilar metals. Pressure gauges are required at hard water inlet and soft water outlet of each softener.
- B. Provide system start-up and subsequent service, with stocking of spare parts by authorized dealer or factory trained personnel.
- C. Provide complete instructions covering installation and operation of the softening system in booklet form. All components shall be easily identified, in exploded views, by individual part number.
- D. Provide six hours of instruction and orientation to the Owner's maintenance staff by factory trained personnel. System walk-through, including programming of any system controllers shall be included in training.

#### **3.04 PRESSURE BOOSTER INSTALLATION**

- A. Provide startup by factory authorized start-up technician.
- B. Mount pressure sensor/transmitter used to control pressure booster pump VFDs remote from booster pump skid near the most remote critical plumbing fixture as indicated on the drawings, and wire signal directly back to pressure booster control panel. Pressure sensor/transmitter signal shall not interface with or be transmitted across any building information system network. Provide signal amplifiers or repeaters as required to ensure proper control operation.

- C. Provide four (4) hours of instruction and orientation to the Owner's maintenance staff by factory trained personnel. System walk-through, including programming of any system controllers, shall be included in the training.
- D. Support piping adjacent to pumps so that no weight is carried by pump casings. Provide supports under elbows on 4" and larger.
- E. Ensure pumps operate at specified fluid temperatures without vapor binding or cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.
- F. Pumps shall be factory aligned. If alignment is not satisfactory, as determined by the Architect/Engineer, manufacturer shall provide a factory trained representative to field align the shafts.
- G. Unless otherwise shown on the drawings, mount all pump skids on 4" high concrete pads and anchor frames to pads with cast-in-place anchors.
- H. All pump skids shall be grouted in. Follow manufacturer's instructions for grouting.
- I. Install on vibration isolators as scheduled on drawings.
- J. Coordinate installation to ensure manufacturer's recommended service clearances are met.

**END OF SECTION**

## SECTION 22 4000 - PLUMBING FIXTURES

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. All plumbing fixtures.

#### 1.02 REFERENCES

- A. ANSI A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
- B. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
- C. ANSI A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
- D. ANSI A112.19.2M - Vitreous China Plumbing Fixtures.
- E. ANSI A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
- F. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
- G. ANSI A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.
- H. ANSI Z358.1 - Emergency Eye Wash and Shower Equipment.
- I. AHRI 1010 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.
- J. ASSE 1002 - Water Closet Flush Tank Ball Cocks.
- K. Americans with Disabilities Act (ADA), Title III.
- L. The Energy Policy Act (EPAAct) of 2005.

#### 1.03 SUBMITTALS

- A. Submit product data under provisions of Section 22 0500. Submittals shall include fixture carriers for record purposes only. Architect/Engineer does not review or approve carriers except for manufacturer.
- B. Include fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. For fixtures and trim requiring electrical connections, submit product data indicating general assembly, components, electrical power/controls wiring diagrams, and service connections.



## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Wall Hung Fixture Carriers:
  - 1. Material: All Metal, ASME/ANSI A112.6.1M.
  - 2. Manufacturers:
    - a. Zurn
    - b. Smith
    - c. Wade
    - d. Josam
    - e. Watts
    - f. Mifab.
  - 3. Water closet carrier shall be rated to support 500 lbs. unless noted otherwise on the drawings.
- B. All fixtures shall be as scheduled on the drawings.
- C. All china shall be from the same manufacturer where possible.
- D. All lavatory and sink trim shall be from the same manufacturer where possible.
- E. All fixtures shall be lead free. Faucets, traps, stops, and other fixture accessories shall not contain more lead than allowed per the latest State or Federal Act.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. General Installation Requirements:
  - 1. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
  - 2. Install each fixture with trap easily removable for servicing and cleaning. Use screwed tailpiece couplings. Connect fixture waste to stack with slip fitting.
  - 3. Provide fixtures with chrome plated rigid or flexible supplies, loose key stops, reducers, and escutcheons.
  - 4. Install components level and plumb.
  - 5. Caulk joint between finish floor and floor mounted fixtures and between finish walls and wall mounted fixtures with silicon caulk. Caulk the joint, between rim and fixture where a fixture builds into a counter top, with caulking compound. Refer to DIVISION 7 for "Caulking" requirements. Color to match fixture.
  - 6. Where there is a possibility of water following pipe brackets, etc., into a wall; caulk escutcheons, space around brackets, etc., to exclude water. Refer to DIVISION 7 for "Caulking" requirements.
  - 7. Refer to architectural drawings for fixture mounting heights.

8. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.

B. Wall-Mounted Fixture Requirements:

1. All wall-mounted fixtures shall have compatible carriers designed for their intended service and suitable for the space available and configuration of fixtures. All carriers shall extend to the floor and be anchored to the slab.

C. Floor-Mounted Fixture Requirements:

1. Where floor mounted fixtures are installed on a sloped floor, the open void below the fixture shall be grouted, leveled, and caulked to eliminate stress on the fixture and to prevent water migration to the floor below.

D. Exposed or Inside Accessible Cabinets Traps, Valve and Pipe Requirements:

1. All traps exposed under fixtures or inside accessible cabinets shall be chrome plated brass.
2. All water or waste piping for plumbing fixtures that is exposed or inside cabinets shall be chrome plated.
3. All exposed flush valves for water closets and urinals shall have a chrome plated hanger to anchor the piping to the wall.
4. All exposed water supply piping and fittings in a finished space to a shower valve, hose bibb, or other water outlet shall be chrome plated.

E. ADA Accessible Exposed Sink and Lavatory Trim:

1. All exposed sink and lavatory traps, piping and angle stops installed at accessible sink and lavatory locations shall include offset style drain tailpiece, p-trap installed near and parallel with back wall, and insulation kit specially manufactured for this installation. Armaflex with duct tape is not acceptable.

F. ADA Accessible Water Closet Requirements:

1. Handicapped accessible water closet flush valve handles shall face the center of the stall.
2. Coordinate flush valves in handicap accessible locations with grab bars installed by the General Contractor. Make modifications as necessary to flush valve piping to avoid conflict with grab bars. Common solutions include shortened or offset vacuum breaker tailpieces.

G. Bathtubs and Shower Requirements:

1. All acrylic and fiberglass bathtubs and showers shall have a non-shrink grout or manufacturer-approved material installed between the finished floor and floor of the fixture to prevent damage caused by deflection.
2. All rough-in pockets for showers and tubs located in basement floor installations shall be filled in with concrete and sealed tight.

### 3.02 ADJUSTING AND CLEANING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

- B. At completion, clean plumbing fixtures, equipment, and faucet aerator screens.

**3.03 FIXTURE ROUGH-IN SCHEDULE**

- A. Rough-in fixture piping connections in accordance with table on plumbing drawings of minimum sizes for particular fixtures.

**END OF SECTION**

## SECTION 23 0500 - BASIC HVAC REQUIREMENTS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Requirements applicable to all Division 23 Sections. Also refer to Division 01 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

#### 1.02 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.
- C. Separate contracts will be awarded for the following work:
- D. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- E. Scope of Work:
  - 1. Plumbing Work: Refer to Section 22 0500 "Basic Plumbing Requirements".
  - 2. Heating Work shall include, but is not necessarily limited to:
    - a. Furnish and install refrigerant piping, accessories, and final charge of refrigerant.
    - b. Furnish and install condensate drain piping from cooling related equipment such as air handlers and cooling coil drain pans.
    - c. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
  - 3. Air Conditioning and Ventilating Work shall include, but is not necessarily limited to:
    - a. Furnish and install package indoor air handling units complete with dampers, filters, coils, fans, and motors.
    - b. Furnish and install package rooftop air handling units complete with curbs.
    - c. Furnish and install air-cooled condensing units and curbs.
    - d. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
    - e. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
    - f. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.
    - g. Furnish and install mechanical room ventilation systems including louvers, ductwork, insulation, and fans.
    - h. Furnish and install all temperature control systems.

- i. Furnish and install all fire dampers.
  - j. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
4. Temperature Control Work shall include, but is not necessarily limited to:
- a. Temperature control system shall consist of a full Direct Digital Control (DDC) system including all accessories, sensors, and programming.
  - b. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
5. Fire Protection Work: Refer to Section 21 0500 "Basic Fire Suppression Requirements".
6. Testing, Adjusting, and Balancing Work shall include, but is not necessarily limited to:
- a. Furnish complete testing, adjusting, and balancing as specified in Section 23 0593, including, but not limited to, air systems, hydronic systems, plumbing systems, and verification of control systems.

### **1.03 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS**

#### **A. Definitions:**

1. "Mechanical Contractors" refers to the following:
  - a. Plumbing Contractor.
  - b. Heating Contractor.
  - c. Air Conditioning and Ventilating Contractor.
  - d. Temperature Control Contractor.
  - e. Fire Protection Contractor.
  - f. Testing, Adjusting, and Balancing Contractor.
2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
  - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.

6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

**B. General:**

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
  - a. Light fixtures.
  - b. Gravity flow piping, including steam and condensate.
  - c. Electrical busduct.
  - d. Sheet metal.
  - e. Electrical cable trays, including access space.
  - f. Sprinkler piping and other piping.
  - g. Electrical conduits and wireway.

**C. Mechanical Contractor's Responsibility:**

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:

- a. Condensing Units.
  - b. Makeup Air Units.
  - c. Package Air Handling Units.
  - d. Packaged Rooftop Units.
2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
  3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
  4. Temperature Control Subcontractor's Responsibility:
    - a. Wiring of all devices needed to make the Temperature Control System functional.
    - b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Subcontractor.
    - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
  5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Subcontractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

#### 1.04 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
  - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.

- b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" (40 mm) and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
  - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" (40 mm) and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
  - d. Maintenance clearances and code-required dedicated space shall be included.
  - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
- 2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
  - 3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

**B. Participation:**

- 1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
- 2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
  - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
- 3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

**C. Drawing Requirements:**

- 1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
  - a. Scale of drawings:
    - 1) General plans: 1/4 Inch = 1'-0" (minimum).
    - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
    - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
    - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).



- 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
  - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
  - b. Potential layout changes shall be made to avoid additional access panels.
  - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
  - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
  - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

## 1.05 QUALITY ASSURANCE

- A. Contractor's Responsibility Prior to Submitting Pricing Data:
1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
  2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.
- B. Qualifications:
1. Only products of reputable manufacturers are acceptable.
  2. All Contractors and subcontractors shall employ only workers skilled in their trades.
- C. Compliance with Codes, Laws, Ordinances:
1. Conform to all requirements of the State of NEW MEXICO Codes, Laws, Ordinances and other regulations having jurisdiction.
  2. Conform to all State Codes.
  3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
  4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
  5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
  6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
  7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
  2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
  3. Pay all charges for permits or licenses.
  4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.

5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Examination of Drawings:

1. The drawings for the mechanical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
  - a. Any item listed as furnished shall also be installed, unless otherwise noted.
  - b. Any item listed as installed shall also be furnished, unless otherwise noted.

F. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.

7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

## 1.06 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

Referenced Specification Section	Submittal Item
23 05 00	Owner Training Agenda
23 05 03	Fire Seal Systems
23 05 13	Motors
23 05 16	Expansion Compensation
23 05 29	Hangers and Supports
23 05 29	Prefabricated Curbs
23 05 48	Vibration Isolation Equipment
23 05 50	Seismic Restraint Systems
23 05 53	HVAC Identification
23 05 93	Testing, Adjusting, and Balancing
23 07 13	Duct Insulation
23 07 19	HVAC Pipe Insulation
23 09 00	Controls
23 09 13	Instrumentation
23 11 13	Facility Fuel-Oil Piping
23 12 13	Facility Fuel-Oil Pumps
23 13 13	Facility Underground Fuel-Oil Storage Tanks
23 13 23	Facility Aboveground Fuel-Oil Storage Tanks
23 21 23	HVAC Pumps
23 22 18	Traps and Condensate Return Equipment
23 22 18	Humidifiers
23 23 00	Refrigeration Piping and Specialties
23 25 00	Chemical Treatment Systems
23 31 00	Ductwork
23 31 00	Ductwork Layout Drawings
23 31 00	Duct Specialties (such as Turning Vanes)
23 33 00	Duct Silencers
23 33 00	Air Blenders
23 33 00	Fire Dampers
23 33 00	Smoke Dampers
23 33 00	Combination Fire Smoke Dampers
23 34 13	Axial Fans
23 34 13.13	Mixed Flow Laboratory Exhaust Fans
23 34 16	Centrifugal Fans
23 34 23	Power Ventilators
23 34 23	Prefabricated Curbs
23 35 14	Dust Collection Systems
23 36 00	Terminal Air Boxes

23 37 00	Grilles, Registers, and Diffusers
23 37 00	Louvers
23 51 00	Prefabricated Stacks
23 52 00	Steam Generators
23 52 16	Condensing Boilers
23 52 23	Cast Iron Boilers
23 52 33.13	Finned Water Tube Boilers
23 52 33.14	High Efficiency Non-condensing Finned Water Tube Boilers
23 52 33.16	Steel Water Tube Boilers
23 52 39	Fire Tube Boilers
23 54 00	Furnaces
23 57 00	Heat Exchangers
23 57 33	Geothermal Heat Exchanger
23 61 16	Refrigerant Compressors
23 62 13	Condensing Units
23 62 13	Air Cooled Condensing Units
23 63 13	Condensers
23 64 13	Absorption Water Chillers
23 64 16	Electric Water Chillers
23 64 17	Process Water Chillers
23 64 19	Reciprocating Water Chillers
23 64 30	Air Cooled Water Chillers
23 64 33	Modular Water Chillers
23 65 13.13	Induced Draft Cooling Tower
23 65 13.14	Blow-Through Cooling Tower
23 65 33	Evaporative Closed Circuit Cooling Tower
23 72 00	Energy Recovery Devices
23 73 13	Indoor Modular Air Handling Units
23 73 23	Custom Air Handling Units
23 74 13	Rooftop Modular Air Handling Units
23 74 16.12	Packaged Rooftop Air Conditioning Units - 25T and Below
23 74 16.13	Packaged Rooftop Air Conditioning Units - Above 25T
23 74 16.14	Packaged Rooftop Air Conditioning Units - High OA
23 74 23.13	Gas Fired Make-Up Air Units
23 75 13	Packaged Water Source Dedicated Outside AHU
23 81 13	Packaged Terminal Air Conditioning Units
23 81 21	Computer Room Units
23 81 26	Split System Air Conditioning Units
23 81 45	Variable Refrigerant Flow Heat Pumps
23 81 46	Packaged Water Source Heat Pumps
23 82 00	Terminal Heat Transfer Equipment
23 82 16	Coils
23 83 00	Radiant Floor Heating Systems
23 84 19	Pool Dehumidification Units

B. General Submittal Procedures: In addition to the provisions of Division 01, the following are required:

1. Transmittal: Each transmittal shall include the following:

a. Date

- b. Project title and number
  - c. Contractor's name and address
  - d. Division of work (e.g., plumbing, heating, ventilating, etc.)
  - e. Description of items submitted and relevant specification number
  - f. Notations of deviations from the contract documents
  - g. Other pertinent data
2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
- a. Date
  - b. Project title and number
  - c. Architect/Engineer
  - d. Contractor and subcontractors' names and addresses
  - e. Supplier and manufacturer's names and addresses
  - f. Division of work (e.g., plumbing, heating, ventilating, etc.)
  - g. Description of item submitted (using project nomenclature) and relevant specification number
  - h. Notations of deviations from the contract documents
  - i. Other pertinent data
  - j. Provide space for Contractor's review stamps
3. Composition:
- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
  - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
  - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
- a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
  - b. Unstamped submittals will be rejected.
  - c. The Contractor's review shall include, but not be limited to, verification of the following:
    - 1) Only approved manufacturers are used.
    - 2) Addenda items have been incorporated.
    - 3) Catalog numbers and options match those specified.
    - 4) Performance data matches that specified.
    - 5) Electrical characteristics and loads match those specified.

- 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
  - 7) Dimensions and service clearances are suitable for the intended location.
  - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
  - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
- d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
  - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
  - b. The Contractor shall clearly indicate the size, finish, material, etc.
  - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
  - d. All marks and identifications on the submittals shall be unambiguous.
- 7. Schedule submittals to expedite the project. Coordinate submission of related items.
  - 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
  - 9. Reproduction of contract documents alone is not acceptable for submittals.
  - 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
  - 11. Submittals not required by the contract documents may be returned without review.
  - 12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
  - 13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
  - 14. Contractor's responsibility for errors, omissions, or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
  - 15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
    - a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.
  - 16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
  - a. Submittal file name: 23 XX XX.description.YYYYMMDD
  - b. Transmittal file name: 23 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

D. Paper Copy Submittal Procedures:

1. Paper copies are acceptable where electronic copies are not provided.
2. The Contractor shall submit ten (10) paper copies of each shop drawing.
3. Each set shall be bound in a three-ring binder or presentation binder. Copies that are loose or in pocket folders are not acceptable.

**1.07 SCHEDULE OF VALUES**

A. The requirements herein are in addition to the provisions of Division 01.

B. Format:

1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
2. Submit in Excel format.
3. Support values given with substantiating data.

C. Preparation:

1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
2. Break down all costs into:
  - a. Material: Delivered cost of product with taxes paid.
  - b. Labor: Labor cost, excluding overhead and profit.
3. Itemize the cost for each of the following:
  - a. Overhead and profit.
  - b. Bonds.
  - c. Insurance.



- d. General Requirements: Itemize all requirements.
4. For each line item having an installed cost of more than \$5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:
- a. Each piece of equipment requiring shop drawings (e.g., each air handling unit, pump, exhaust fan, etc.). Use the equipment nomenclature (AHU-1, P-1, EF-1, etc.) on the Schedule of Values.
  - b. Each type of small unitary equipment (e.g., FCUs, UHs, CABs, etc.). Multiple units of the same type can be listed together, provided quantities are also listed so unit costs can be determined.
  - c. Each piping system (chilled water, heating water, steam, condensate, etc.). In addition, for larger projects, break down the material and labor for each piping system based on geography (building, floor, and/or wing).
  - d. Each duct system (supply, return, relief, outside air, etc.) listed separately for each unit they serve (AHU-1 supply air ductwork, AHU-1 return air ductwork, etc.).
  - e. Pipe insulation with separate material and labor line items for each piping system listed above.
  - f. Duct insulation with separate material and labor line items for each duct system listed above.
  - g. Temperature controls broken down into material and labor for the following:
    - 1) Engineering
    - 2) Controllers, devices, sensors, etc.
    - 3) Control valves
    - 4) Control dampers
    - 5) Conduit
    - 6) Wiring
    - 7) Programming
    - 8) Commissioning
  - h. Site utilities (5' beyond building)
  - i. Air balancing
  - j. Commissioning
  - k. Record drawings
  - l. Punchlist and closeout

D. Update Schedule of Values when:

- 1. Indicated by Architect/Engineer.
- 2. Change of subcontractor or supplier occurs.
- 3. Change of product or equipment occurs.

**1.08 Change orders**

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

- C. Change order work shall not proceed until authorized.

#### **1.09 EQUIPMENT SUPPLIERS' INSPECTION**

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
  - 1. Air Cooled Condensers
  - 2. Condensing Units
  - 3. Gas Fired Makeup Air Units
  - 4. Fire Seal Systems
- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

#### **1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE**

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

#### **1.11 NETWORK / INTERNET CONNECTED EQUIPMENT**

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

#### **1.12 WARRANTY**

- A. Provide two-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

#### **1.13 INSURANCE**

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

#### **1.14 CONTINGENCY**

- A. Include in the Base Bid a contingency of ten (10) percent to be used only by change orders issued by the Architect/Engineer. The unused portion of the contingency shall be deducted from the Contract price before final payment is made.

#### **1.15 MATERIAL SUBSTITUTION**

- A. Where several manufacturers' names are given, the scheduled manufacturer is the basis for job design and establishes the quality required.
- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

#### **1.16 PROJECT COMMISSIONING**

- A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 23 08 00 and provide all services as described in the Commissioning Plan.

## **PART 2 - EXECUTION**

### **2.01 JOBSITE SAFETY**

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

### **2.02 ARCHITECT/ENGINEER OBSERVATION OF WORK**

- A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
  - 1. Covering exterior walls, interior partitions and chases.
  - 2. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
  - 1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
    - a. Pipe insulation is installed and fully sealed.
    - b. Pipe and duct wall penetrations are sealed.
    - c. Pipe identification and valve tags are installed.
    - d. Main, branch and flexible ducts are installed.
    - e. Diffusers, registers and grilles are installed and connected to ductwork.
  - 2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
  - 3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

### **2.03 PROJECT CLOSEOUT**

- A. The following paragraphs supplement the requirements of Division 01.
- B. Final Jobsite Observation:

1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

C. Before final payment is authorized, this Contractor must submit the following:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including marked-up or reproducible drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

## **2.04 OPERATION AND MAINTENANCE MANUALS**

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
  - a. O&M file name: O&M.div23.contractor.YYYYMMDD
  - b. Transmittal file name: O&Mtransmittal.div23.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Refer to Section 23 0900 for additional requirements for Temperature Control submittals.
5. Copy of final approved test and balance reports.
6. Copies of all factory inspections and/or equipment startup reports.
7. Copies of warranties.
8. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
9. Dimensional drawings of equipment.
10. Capacities and utility consumption of equipment.
11. Detailed parts lists with lists of suppliers.
12. Operating procedures for each system.
13. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
14. Repair procedures for major components.
15. List of lubricants in all equipment and recommended frequency of lubrication.
16. Instruction books, cards, and manuals furnished with the equipment.

**2.05 INSTRUCTING THE OWNER'S REPRESENTATIVES**

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.
- D. The instructions shall include:

1. Explanation of all system flow diagrams.
  2. Explanation of all air handling systems.
  3. Temperature control system operation including calibration, adjustment and proper operating conditions of all sensors.
  4. Maintenance of equipment.
  5. Smoke control systems.
  6. Stairwell pressurization systems.
  7. Start-up procedures for all major equipment.
  8. Explanation of seasonal system changes.
  9. Description of emergency system operation.
- E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.
- F. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- G. Operating Instructions:
1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
  2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

## **2.06 SYSTEM STARTING AND ADJUSTING**

- A. The mechanical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Operate all HVAC systems continuously for at least one week prior to occupancy to bring construction materials to suitable moisture levels. Areas with mechanical cooling shall be maintained below 60% RH.
- D. Contractor shall adjust the mechanical systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- E. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.

- F. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

## **2.07 RECORD DOCUMENTS**

- A. The following paragraphs supplement Division 01 requirements.
- B. Maintain at the job site a separate and complete set of mechanical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings to indicate revisions to piping and ductwork, size and location, both exterior and interior; including locations of coils, dampers, other control devices, filters, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (e.g., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
- D. Refer to Section 23 0900 for additional requirements for Temperature Control documents.

## **2.08 PAINTING**

- A. This Contractor shall paint the following items:
  - 1. All piping in mechanical room
  - 2. Piping exposed in kitchen
- B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- C. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer the color preference and furnish this color.
- E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.



- F. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.

## **2.09 ADJUST AND CLEAN**

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all drain pans and areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed bare metal ductwork, piping, hangers, and accessories.
- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

## **2.10 SPECIAL REQUIREMENTS**

- A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

## **2.11 MAINTAINING CLEAN DUCTWORK THROUGHOUT CONSTRUCTION**

- A. Throughout the duration of construction, all ductwork shall be capped or sealed with sheet metal caps, polyethylene film, or other airtight protective to keep dust, dirt, and construction debris out of ducts. Similar means shall be used to seal air-side connections of HVAC equipment to include, but not limited to, air handling units, fans, terminal air boxes, fan coil units, cabinet heaters, blower coils, and the like.
- B. Should HVAC equipment be started during construction, Contractor shall remove airtight protectives and shall install one-inch thick MERV 8 filter media over all return and exhaust grilles to prevent dust, dirt, and construction debris from entering ductwork. Filter media shall cover the entire grille face and shall be secured such that air cannot bypass filter media.
- C. Should filter media become laden with dust and dirt, Contractor shall replace filter media with new media to prevent damage to air distribution system and equipment.
- D. The following steps shall be taken during testing, adjusting, and balancing of each air system:
  - 1. All construction activities in all spaces served by the air system shall stop.
  - 2. All airtight protectives and temporary filter media shall be removed from all portions of the air system.
  - 3. Testing, adjusting, and balancing work shall not commence until all construction activity is stopped and all airtight protectives and temporary filter media is removed.

4. Once testing, adjusting, and balancing work is complete for the air system, airtight protectives or temporary filter media shall be installed over all ductwork openings and air terminals on the air system prior to resuming construction activities in any spaces served by the air system.
- E. The Owner shall agree the building is sufficiently clean prior to the removal of any filtration media and airtight protectives from air terminal devices.

## **2.12 UTILITY REBATE**

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.
- B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

## READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All air handling units operating and balanced.
3. All fans shall be operating and balanced.
4. All pumps, boilers and chillers operating and balanced.
5. All miscellaneous mechanical systems (unit heaters, fan coil units, cabinet heaters, etc.) operating.
6. All temperature control systems operating, programmed and calibrated.
7. Pipe insulation complete, pipes labeled and valves tagged.
8. Fire damper and fire/smoke damper access doors labeled in accordance with specifications.

Accepted by:

Prime Contractor \_\_\_\_\_

By \_\_\_\_\_ Date \_\_\_\_\_

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

**END OF SECTION**

## SECTION 23 0503 - THROUGH PENETRATION FIRESTOPPING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Through-Penetration Firestopping.

#### 1.02 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

#### 1.03 REFERENCES

- A. UL 263 - Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. The Building Officials and Code Administrators National Building Code
- J. 2021 International Building Code
- K. NFPA 5000 - Building Construction Safety Code

#### 1.04 SUBMITTALS

- A. Submit under provisions of Section 23 0500 .
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
  2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
  3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
  4. F ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

#### **1.06 PERFORMANCE REQUIREMENTS**

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
  2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
  2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq. ft at both ambient temperature and 400°F for smoke barriers.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

#### **1.07 MEETINGS**

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the , General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
  - 1. Review foreseeable methods related to firestopping work.
  - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

#### **1.08 WARRANTY**

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
  - 1. 3M; Fire Protection Products Division.
  - 2. Hilti, Inc.
  - 3. RectorSeal Corporation, Metacaulk.
  - 4. Tremco; Sealant/Weatherproofing Division.
  - 5. Johns-Manville.
  - 6. Specified Technologies Inc. (S.T.I.)
  - 7. Spec Seal Firestop Products
  - 8. AD Firebarrier Protection Systems
  - 9. Dow Corning Corp.
  - 10. Fire Trak Corp.
  - 11. International Protective Coating Corp.

#### **2.02 THROUGH PENETRATION FIRESTOP SYSTEMS**

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.
- E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- F. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

- a. F Rating = Floor/Wall Rating
- b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

2. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

- a. F Rating = Wall/Floor Rating
- b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

\*Alternate method of firestopping is patching opening to match

Penetrating Item  
original rated construction.

UL System No.

- H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

#### **3.02 INSTALLATION**

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

#### **3.03 CLEANING AND PROTECTING**

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.



- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

### **3.04 IDENTIFICATION**

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
  - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

### **3.05 INSPECTION**

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the contractor's expense.

**END OF SECTION**

## SECTION 23 0529 - HVAC SUPPORTS AND ANCHORS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Hangers, Supports, and Associated Anchors.
- B. Equipment Bases and Supports.
- C. Sleeves and Seals.
- D. Flashing and Sealing of Equipment and Pipe Stacks.
- E. Cutting of Openings.

#### 1.02 REFERENCES

- A. ANSI/ASME B31.1 - Power Piping.
- B. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- C. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
- D. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- E. MSS SP-127 - Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application

#### 1.03 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 23 0500. Include plastic pipe manufacturers' support spacing requirements.

#### 1.04 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

### PART 2 - PRODUCTS

#### 2.01 HANGER RODS

- A. Hanger rods for single rod hangers shall conform to the following:

Pipe Size	Hanger Rod Diameter	
	Column #1	Column #2
2-1/2" and smaller	3/8"	3/8"
3" through 3-5/8"	3/8"	3/8"
4" and 5"	1/2"	1/2"

6"	3/4"	5/8"
8" through 12"	7/8"	3/4"
14"	1"	7/8"
16" and 18"	1"	N/A
20" and 24"	1-1/4"	N/A

Column #1: Steel pipe.

Column #2: Copper, plastic and fiberglass reinforced pipe.

- B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.
- C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

## 2.02 PIPE AND STRUCTURAL SUPPORTS

### A. General:

1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).
2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.

### B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, unless otherwise noted by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings, or lugs. Provide sufficient flexibility to accommodate expansion and contraction to avoid compromising fire barrier penetrations or stressing piping at fixed takeoff locations.
2. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs. Wall supports shall be coordinated with the Structural Engineer.

### C. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp within their temperature limits of -65°F to +275°F.
3. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
4. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.

- a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
- b. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

### **2.03 FOUNDATIONS, BASES, AND SUPPORTS**

#### **A. Basic Requirements:**

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

#### **B. Supports:**

1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.

#### **C. Grout:**

1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.
2. Use Mix No. 1 for clearances of 1" or less, and Mix No. 2 for all larger clearances.
3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

### **2.04 OPENINGS IN FLOORS, WALLS AND CEILINGS**

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.

- F. Exposed Housing Penetrations: Seal pipes with surface temperature below 150°F, penetrating housings with conical stepped, white silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite.

## **2.05 ROOF PENETRATIONS**

- A. Roof Curb Enclosure: Provide weatherproof roof curb and enclosure for pipe and duct penetrations. Refer to drawings for details.
- B. Conical Pipe Boot: Seal pipes with surface temperature below 150°F penetrating single-ply roofs with conical stepped, UV-resistant silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite. Color: Black shall match roofing material.
- C. Break insulation only at the clamp for pipes between 60°F and 150°F. Seal outdoor insulation edges watertight.

## **2.06 SLEEVES AND LINTELS**

- A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.
- B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.
- C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.
- D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas.
- E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Architect/Engineer's design.
- F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
- G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
- H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (e.g., foam, rubber, asphalt-coated fiber, bituminous-impregnated felt, or cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
- I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.
- J. Wall Seals ("Link-Seals"):

1. Where shown on the drawings, pipes passing through walls, ceilings, or floors shall have their annular space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing elements consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve. If piping carries only fluids below 120°F, sleeves may be thermoplastic with integral water seal and textured surface.
3. Sleeves shall be at least 2 pipe sizes larger than the pipes.
4. Pressure shall be maintained by stainless steel bolts and other parts. Pressure plates may be of composite material for Models S and OS.
5. Sealing element shall be as follows:

<u>Model</u>	<u>Service</u>	<u>Element Material</u>	<u>Temperature Range</u>
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	High/Low Temperature (Steam)	Silicone	-67°F to 400°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant/Stainless	Nitrile	-40°F to 210°F

6. Manufacturers:
  - a. Thunderline Corporation "Link-Seals"
  - b. O-Z/Gedney Company
  - c. Calpico, Inc.
  - d. Innerlynx
  - e. Metraflex Company (cold service only)

## **2.07 PIPE PENETRATIONS**

- A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.
- B. Seal fire rated wall and floor penetrations with fire seal system as specified.

## **2.08 PIPE ANCHORS**

- A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.
- B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

## **2.09 FINISH**

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

## **PART 3 - EXECUTION**

### **3.01 HVAC SUPPORTS AND ANCHORS**

- A. General Installation Requirements:
  - 1. Install all items per manufacturer's instructions.
- B. Supports Requirements:
  - 1. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
  - 2. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.
- C. Pipe Requirements:
  - 1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
  - 2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
  - 3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
  - 4. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
- D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
  - 1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
  - 2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
    - a. The hanger is attached within 6" from a web/chord joint.
    - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
  - 3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
  - 4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
- H. Steel/Concrete Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:
  - 1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):
    - a. Maximum Spacing:
      - 1) 1-1/4" & under: 7'-0"
      - 2) 1-1/2": 9'-0"
      - 3) 2": 10'-0"
      - 4) 2-1/2": 11'-0"
      - 5) 3": 12'-0"
      - 6) 4" & larger: 12'-0"
  - 2. Steel (Std. Weight or Heavier - Vapor Service):
    - a. Maximum Spacing:
      - 1) 1-1/4" and under: 9'-0"
      - 2) 1-1/2": 12'-0"
      - 3) 2" & larger: 12'-0"
  - 3. Hard Drawn Copper & Brass (Liquid Service):
    - a. Maximum Spacing:
      - 1) 3/4" and under: 5'-0"
      - 2) 1": 6'-0"
      - 3) 1-1/4": 7'-0"
      - 4) 1-1/2": 8'-0"
      - 5) 2": 8'-0"
      - 6) 2-1/2": 9'-0"
      - 7) 3": 10'-0"
      - 8) 4": 12'-0"
      - 9) 6": 12'-0"
  - 4. Hard Drawn Copper & Brass (Vapor Service):
    - a. Maximum Spacing:
      - 1) 3/4" & under: 7'-0"
      - 2) 1": 8'-0"



- 3) 1-1/4": 9'-0"
- 4) 1-1/2": 10'-0"
- 5) 2": 11'-0"
- 6) 2-1/2" & larger: 12'-0"

5. Plastic Pipe:

- a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.

6. Ultra-Flexible Pipe, Flexible Hose, and Soft Copper Tubing:

- a. Continuous channel with hangers maximum 8'-0" OC.

I. Wood Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):

a. Maximum Spacing:

- 1) 1-1/4" & under: 7'-0"
- 2) 1-1/2": 9'-0"
- 3) 2": 10'-0"
- 4) 2-1/2": 11'-0"
- 5) 3": 12'-0"
- 6) 4" through 6": 12'-0" 8": 9øø-0" 10": 6øø-0" 12": 4øø-0"

2. Steel (Std. Weight or Heavier - Vapor Service):

a. Maximum Spacing:

- 1) 1-1/4" and under: 9'-0"
- 2) 1-1/2": 12'-0"
- 3) 2" & larger: 12'-0"
- 4) 2-1/2": 11'-0"
- 5) 3": 12'-0"
- 6) 4" through 8": 12'-0"
- 7) 10": 9øø-0"
- 8) 12": 6øø-0"

3. Hard Drawn Copper & Brass (Liquid Service):

a. Maximum Spacing:

- 1) 3/4" and under: 5'-0"
- 2) 1": 6'-0"
- 3) 1-1/4": 7'-0"
- 4) 1-1/2" 8'-0"
- 5) 2": 8'-0"

- 6) 2-1/2": 9'-0"
- 7) 3": 10'-0"
- 8) 4": 12'-0"
- 9) 6": 12'-0"

4. Hard Drawn Copper & Brass (Vapor Service):

a. Maximum Spacing:

- 1) 3/4" & under: 7'-0"
- 2) 1": 8'-0"
- 3) 1-1/4": 9'-0"
- 4) 1-1/2": 10'-0"
- 5) 2": 11'-0"
- 6) 2-1/2" & larger: 12'-0"

5. Plastic Pipe:

- a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.

6. Ultra-Flexible Pipe, Flexible Hose, and Soft Copper Tubing:

- a. Continuous channel with hangers maximum 8'-0" OC.

J. Installation of hangers shall conform to MSS SP-58, 69, and 89.

**END OF SECTION**

## SECTION 23 0530 - ROOF SUPPORT AND WIND BRACING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Wind Restraint of Rooftop Equipment
- B. Rooftop Access and Service Platforms
- C. Rooftop Duct Support
- D. Rooftop Pipe Support
- E. Rooftop Equipment Support

#### 1.02 QUALITY ASSURANCE

- A. General:
  - 1. The Contractor shall retain a specialty consultant or equipment manufacturer to develop a wind restraint and support system and perform wind restraint calculations in accordance with these specifications, state, and local codes.
  - 2. These requirements are beyond those listed in Section 23 0550 of these specifications. Where a conflict arises between the wind restraint of this section and any other section, the Architect/Engineer shall be immediately notified for direction to proceed.
- B. Manufacturer:
  - 1. System Supports/Restrains: Company specializing in the manufacture of products specified in this section.
  - 2. Equipment: Each company providing equipment that must meet wind restraint requirements shall provide certification included in project submittals that the equipment supplied for the project meets or exceeds the wind restraint of the project.
- C. Installer: Installed by Contractor.

#### 1.03 REFERENCES

- A. International Building Code 2015
- B. ASCE 7-10, Chapter 29

#### 1.04 SUBMITTALS

- A. Submit under provisions of Section 23 0500.

**1.05 TESTING AND INSPECTION**

**1.06 DELIVERY, STORAGE AND HANDLING**

- A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

**1.07 DESIGN REQUIREMENTS**

- A. This project is subject to the wind loading requirements of the International Building Code 2015 edition.

**1.08 COORDINATION**

- A. Coordinate layout and installation of anchoring with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.

**1.09 WARRANTY**

- A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

**PART 2 - PRODUCTS**

**2.01 SUPPLIERS**

- A. Miro Industries

**2.02 ACCESS AND SERVICE STAIRS AND PLATFORMS**

- A. Provide prefabricated OSHA 1910 compliant structure over obstructions and access to equipment installed on the roof as shown on the drawings. Supports include stanchioned supports anchored to the roof structure. Refer to drawings for stairs and/or service platform size, layout, and roofing material.
- B. Roof equipment support manufacturer shall provide ASCE-7 code-compliant sealed submittal to support and restrain access and service stair and platforms for uplift and lateral loading.
- C. Frame and Railing: Support frame and platform shall be hot dipped galvanized steel minimum 12-gauge channel or tube steel. Manufacturer shall determine final design.
- D. Decking: Support decking shall be minimum 1" thick, non-slip hot dipped galvanized bar grating.
- E. Minimum clear height above obstructions shall be 24 inches .
- F. Acceptable Manufacturer:
  - 1. Miro Industries Stanchioned Crossover Stairs

### **2.03 ROOF DUCT SUPPORTS**

- A. Roof duct support manufacturer shall provide ASCE-7 code-compliant sealed submittal to support and restrain rooftop duct system for uplift and lateral loading.
- B. Refer to drawings for duct size, layout, structural framing, roofing material, and wind loading information.
- C. Provide adjustable pre-fabricated roof duct supports for all duct installed on the roof. Supports include a combination of non-penetrating pillow block duct supports and stanchioned supports anchored to the roof structure.
- D. Supports shall be constructed from hot dipped galvanized steel minimum 12-gauge channel or tube steel. Manufacturer shall determine final design.
- E. Pillow block base shall be UV resistant polycarbonate rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
- F. Acceptable Manufacturer:
  - 1. Miro Industries DS and Stanchioned DS

### **2.04 ROOF PIPING SUPPORTS**

- A. Non-Penetrating Pillow Block Supports:
  - 1. Provide pre-fabricated non-penetrating pillow block roof pipe supports for all piping installed on the roof.
  - 2. Pillow block base shall be UV resistant polycarbonate rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
  - 3. Acceptable Products:
    - a. Anvil International HBS-Base Series
    - b. Cooper B-Line Dura-Blok
    - c. Erico Caddy Pyramid 50, 150, 300, or 600 (to match load)
    - d. Miro Industries 1.5, 3-R, 4-R or 5-R (to match pipe)
- B. Premanufactured Anchored Roof Pipe Supports:
  - 1. Roof duct support manufacturer shall provide ASCE-7 code-compliant sealed submittal to support and restrain rooftop piping system for uplift and lateral loading.
  - 2. Refer to drawings for pipe size, layout, structural framing, roofing material, and wind loading information.
  - 3. Provide adjustable pre-fabricated pipe supports for all pipe installed on the roof. Supports include a combination of non-penetrating pillow block pipe supports and stanchioned supports anchored to the roof structure.
    - a. Supports shall be constructed from hot dipped galvanized steel minimum 12-gauge channel or tube steel. Manufacturer shall determine final design.
  - 4. Pillow block base shall be UV resistant polycarbonate rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
  - 5. Acceptable Manufacturer:

- a. Miro Industries DS and Stanchioned DS

## 2.05 ROOF EQUIPMENT SUPPORTS

### A. Premanufactured Equipment Roof Support Frames:

1. Roof equipment support manufacturer shall provide ASCE-7 code-compliant sealed submittal to support and restrain rooftop equipment for uplift and lateral loading.
2. Refer to drawings for equipment size, layout, structural framing, roofing material, and wind speed.
3. Provide adjustable prefabricated roof equipment supports for all equipment installed on the roof. Supports include stanchioned supports anchored to the roof structure.
4. Frame: Support frame shall be hot dipped galvanized steel minimum 12 gauge channel or tube steel. Manufacturer shall determine final design.
5. Decking: Support decking shall be minimum 1" thick, non-slip hot dipped galvanized bar grating.
6. Equipment requiring support frames is as follows:
  - a. Condensing units
  - b. Split system outdoor units
7. Minimum clear height above roof shall be 24 inches .

### B. Equipment Roof Curbs and Rails:

1. Equipment requiring curbs or rails with this section is as follows:
  - a. Condensing units
2. Provide prefabricated curbs or rails as follows:
  - a. Roof Mounting Curb: Curb height as shown on drawings, minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood nailer.
  - b. 14 or 18 gauge galvanized sheet metal, as required for the equipment weight.
  - c. Internal reinforcing.
  - d. Pressure treated wood nailer.
  - e. 18 gauge counter flashing completely covering nailer.
  - f. Factory insulated with rigid fiberglass.
3. Refer to drawings for curb and rail heights.
4. Match units to the building roof with either a raised cant to match roof insulation (for built-up roofs) or with no cant (for single-ply roofs).
5. Where legs of equipment rest on rails, provide 1/4" bent plates 18" long.
6. Manufacturers:
  - a. Thy
  - b. Pate
  - c. United
  - d. Roof Products Systems
  - e. Portals Plus

### C. Rooftop Air Handling Units:

1. Standard Curb: Rooftop equipment such as packaged air handling units shall be provided with curbs by the unit manufacturer. Refer to individual equipment sections for curb description.
  2. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
  3. This section shall provide anchoring such as Z-clip wind restraint brackets, guy wires, tethers or straps to limit wind disruption.
  4. Roof equipment support manufacturer shall provide ASCE-7 code-compliant sealed submittal to support and restrain rooftop equipment for uplift and lateral loading.
- D. Exhaust Fans, Roof Hoods, Etc.:
1. Curb provided with equipment. Rooftop equipment such as roof hoods and rooftop exhaust fans shall be provided with curbs by the unit manufacturer. Refer to individual equipment sections for curb description.
  2. This section shall provide anchoring such as guy wires, tethers, or straps to limit wind disruption.
  3. Roof equipment support manufacturer shall provide ASCE-7 code-compliant sealed submittal to support and restrain rooftop equipment for uplift and lateral loading.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL**

- A. Install all items per manufacturer's instructions.
- B. All wind restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- C. Installation of wind restraints shall not cause any change in position of equipment, piping, or ductwork resulting in stresses or misalignment.
- D. Prior to installation, bring to the Architect/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
- E. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast-in-place inserts.
- F. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment, ductwork, piping, or conduit. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only. Do not install cables over sharp corners.
- G. Provide reinforced clevis bolts when required.
- H. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.

- I. Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent piping.
- J. Positively attach all roof-mounted equipment to roof curbs. Positively attach all roof curbs to building structure.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- L. Supports shall extend directly to building structure.
- M. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the drawings as being by others.
- N. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
- O. Roof Supports: Install per manufacturer's requirements. Coordinate with Roofing Contractor.

### **3.02 ROOF PIPING SUPPORTS**

- A. Roof Supports: Install per manufacturer's requirements. Coordinate with Roofing Contractor.
- B. Install roof pipe supports to resist wind movement per manufacturer's recommendations. Method of securing base to roof shall be compatible with roofing materials.
- C. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.
- D. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories, to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
- E. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
- F. Support piping at equipment and valves so it can be disconnected and removed without further supporting the piping.
- G. Piping shall not introduce strains or distortion to connected equipment.
- H. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, and at equipment connections and heavy fittings.
- I. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.
- J. Spacing: Refer to Supports and Anchors section for pipe spacing requirements.



### **3.03 INSPECTION**

- A. Special inspection and testing shall be done in accordance with Chapter 17 of the Building Code.
- B. The Contractor shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.
- C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Architect and Engineer of Record.
- D. The Special Inspection Agency shall furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

**END OF SECTION**

## SECTION 23 0553 - HVAC IDENTIFICATION

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Identification of products installed under Division 23.

#### 1.02 REFERENCES

- A. ASTM B-1, B-3, and B-8 for copper conductors.
- B. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 - 2kV Cables.
- C. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

#### 1.03 SUBMITTALS

- A. Submit shop drawings under provisions of Section 23 0500. Include list of items identified, wording, letter sizes, and color coding.
- B. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. 3M
- B. Bunting
- C. Calpico
- D. Craftmark
- E. Emedco
- F. Kolbi Industries
- G. Seton
- H. W.H. Brady
- I. Marking Services.

## 2.02 MATERIALS

- A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

OD of Pipe or Insulation	Marker Length	Size of Letters
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"
8" to 10"	24"	2-1/2"
Over 10"	32"	3-1/2"

Plastic tags may be used for outside diameters under 3/4"

- B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
- C. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.
- D. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.
- E. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.
- F. Ductwork Markers:
1. Ductwork systems containing hazardous materials shall be provided with minimum 2" x 4" ANSI Z535.2 biohazard warning labels with custom labeling describing hazard. Refer to Part 3 for system and label description.
  2. Vinyl Markers: Colored vinyl with permanent pressure sensitive adhesive backing suitable for indoor and outdoor application.
- G. Maintenance Access Doors:
1. Doors and roof hatches used to access equipment serving hazardous ductwork systems shall be provided with a minimum 4" x 6" ANSI Z535.2 biohazard warning label. Label shall read "WARNING - BIOHAZARD. ONLY AUTHORIZED PERSONNEL BEYOND THIS POINT".
  2. Coordinate location of warning label with Owner.
- H. Ceiling Markers:
1. Label Style:
    - a. The intent is for the ceiling labels to be inconspicuous but easy to find and read while standing underneath. The labels shall be located on the grid T-bar nearest the ceiling tile that can be removed to provide the best access to the serviceable side of equipment or to valves. An arrow can be used to point to the tile needing removal.

- b. The label tape shall be approximately 1/2" wide with all capitalized letters approximately 3/16" tall.
- c. Ceiling grid labels shall be made with a label maker with durable adhesive labels having a clear background and black letters.
- d. Equipment labels shall be as designated on the drawings (e.g., FCU-606B, etc.).
- e. Valve labels shall be designated by the size, service, and the valve tag number (e.g., 1-1/4" CW #123, 2" HWS #234, etc.). A single longer label can be used to identify multiple valves using spaces between the descriptors if the valves are located close together and have the same service (e.g., HWS and HWR valves serving the same equipment or CW, HW, and HWC lines serving the same restroom, etc.).
- f. Fire, fire/smoke and smoke dampers shall be labeled consistent with the type (e.g., Fire Damper, Fire/Smoke Damper, etc.).

2. "Dot" Style:

- a. The intent is for the ceiling labels to be inconspicuous but easy to find and read while standing underneath. The labels shall be located on the grid T-bar nearest the ceiling tile that can be removed to provide the best access to the serviceable side of equipment or to valves.
- b. The marker shall be a self-adhesive color dot approximately 1/2" in diameter.
- c. The equipment and accessories to be marked and dot color shall be coordinated with the Architect/Engineer and Owner.
  - 1) Equipment and accessories to be marked:
    - a) Hydronic Valves
    - b) Fire Dampers
    - c) Fire/Smoke and Smoke Dampers
    - d) Fan Coil Units
    - e) Project Specific Item

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Equipment:
  - 1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function such as air handling units, exhaust fans, filters, reheat coils, dampers, etc.; shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
  - 2. Fasten nameplates or plastic tags with stainless steel self-tapping screws or permanently bonding cement.

3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

D. Miscellaneous:

1. Attach self-adhesive vinyl labels at all duct access doors used to reset fusible links or actuators on fire, fire/smoke, or smoke dampers. Lettering shall be a minimum of 1/2" high. Labels shall indicate damper type.
2. Provide engraved plastic tags at all hydronic or steam system make-up water meters.

**END OF SECTION**

## **SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Testing, adjusting, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.

#### **1.02 QUALITY ASSURANCE**

- A. Agency shall be a company specializing in the adjusting and balancing of systems specified in this section with minimum three years' experience. Perform work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, SMARTA Certified Air and Hydronic Balancer, or TABB Certified Supervisor.
- B. Work shall be performed in accordance with the requirements of the references listed at the start of this section.

#### **1.03 REFERENCES**

- A. AABC - National Standards for Total System Balance, Seventh Edition.
- B. ADC - Test Code for Grilles, Registers, and Diffusers.
- C. AMCA - Publication 203-90; Field Performance Measurement of Fan Systems.
- D. ASHRAE - 2019 HVAC Applications Handbook; Chapter 39, Testing, Adjusting and Balancing.
- E. ASHRAE/ANSI - Standard 111-2008; Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC&R Systems.
- F. NEBB - Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems, Ninth Edition, 2019.
- G. SMACNA - HVAC Systems; Testing, Adjusting and Balancing (latest edition).
- H. TABB - International Standards for Environmental Systems Balance.

#### **1.04 SUBMITTALS**

- A. Submit copies of report forms, balancing procedures, and the name and qualifications of testing and balancing agency for approval within 30 days after award of Contract.
- B. Electronic Copies:

1. Submit a certified copy of test reports to the Architect/Engineer for approval. Electronic copies shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Copies that are not legible will be returned to the Contractor for resubmittal. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
2. Electronic file size shall be limited to a maximum of 10MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
3. All text shall be searchable.
4. Bookmarks shall be used. All bookmark titles shall be an active link to the index page and index tabs.

#### **1.05 REPORT FORMS**

- A. Submit reports on AABC, SMACNA or NEBB forms. Use custom forms approved by the Architect/Engineer when needed to supply specified information.
- B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.
- C. Refer to PART 4 for required reports.

#### **1.06 WARRANTY/GUARANTEE**

- A. The TAB Contractor shall include an extended warranty of 90 days after owner receipt of a completed balancing report, during which time the Owner may request a recheck of terminals, or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of 24 manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.
- B. Warranty/Guarantee must meet one of the following programs: TABB International Quality Assurance Program, AABC National Project Performance Guarantee, NEBB's Conformance Certification.

#### **1.07 SCHEDULING**

- A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Architect/Engineer prior to performing each test.
- B. Project will be constructed in phases. Provide balancing report after each phase is complete.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION**

### **3.01 GENERAL REQUIREMENTS**

- A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the contract documents shall be balanced using a procedure from a published standard listed in the References article.
- B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g. submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.
- C. Recorded data shall represent actual measured or observed conditions.
- D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.
- E. Permanently mark setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.
- G. The Balancing Contractor shall measure terminal air box air flow, and the TCC shall adjust DDC readout to match. Refer to Section 23 0900 for additional information.
- H. Installations with systems consisting of multiple components shall be balanced with all system components operating.

### **3.02 EXAMINATION**

- A. Before beginning work, verify that systems are complete and operable. Ensure the following:
  - 1. General Equipment Requirements:
    - a. Equipment is safe to operate and in normal condition.
    - b. Equipment with moving parts is properly lubricated.
    - c. Temperature control systems are complete and operable.
    - d. Proper thermal overload protection is in place for electrical equipment.
    - e. Direction of rotation of all fans and pumps is correct.
    - f. Access doors are closed and end caps are in place.
  - 2. Duct System Requirements:
    - a. All filters are clean and in place. If required, install temporary media.



- b. Duct systems are clean and free of debris.
- c. Fire/smoke and manual volume dampers are in place, functional and open.
- d. Air outlets are installed and connected.
- e. Duct system leakage has been minimized.

3. Pipe System Requirements:

- a. Coil fins have been cleaned and combed.
- b. Hydronic systems have been cleaned, filled, and vented.
- c. Strainer screens are clean and in place.
- d. Shutoff, throttling and balancing valves are open.

- B. Report any defects or deficiencies to Architect/Engineer.
- C. Promptly report items that are abnormal or prevent proper balancing.
- D. If, for design reasons, system cannot be properly balanced, report as soon as observed.
- E. Beginning of work means acceptance of existing conditions.

**3.03 PREPARATION**

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect/Engineer for spot checks during testing.
- B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

**3.04 INSTALLATION TOLERANCES**

- A.  $\pm 10\%$  of scheduled values:
  - 1. Adjust air inlets and outlets to  $\pm 10\%$  of scheduled values.
  - 2. Adjust piping systems to  $\pm 10\%$  of design values.
- B.  $\pm 5\%$  of scheduled values:
  - 1. Adjust fume exhaust systems to  $\pm 5\%$  of scheduled values.
  - 2. Adjust supply and exhaust air-handling systems for space pressurization to  $\pm 5\%$  of scheduled values, and to provide proper pressurization.
- C.  $+ 5\%$  of scheduled values
  - 1. Adjust outdoor air intakes to within  $+ 5\%$  of scheduled values.
  - 2. Adjust exhaust air through energy recovery equipment to within  $+5\%$  of scheduled values.
- D. Adjust supply, return, and exhaust air-handling systems to  $+10\% / -5\%$  of scheduled values.

**3.05 ADJUSTING**

- A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.

- B. Once balancing of systems is complete, at least one damper or valve must be 100% open.
- C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.
- D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.
- E. Contractor responsible for pump shall trim impeller to final duty point as instructed by this contractor on all pumps not driven by a VFD. Coordinate with contractor.

### **3.06 SYSTEM PERFORMANCE REPORT**

- A. After the conclusion of balancing operations, utilize the building DDC system or install portable data loggers to simultaneously record temperatures and humidity during summer and winter conditions for a seven-day period, continuous over a weekend, and including at least one period of operation at outside conditions within 5°F wet bulb temperature of maximum summer design condition and within 10°F dry bulb temperature of minimum winter design condition.
- B. Design Conditions:
  - 1. Summer: 96.1 °F DB 59.4 °F WB
  - 2. Winter: 1 °F DB
- C. Architect/Engineer will direct all test locations.
- D. Report of test results shall include original recording and three reproductions.

### **3.07 SUBMISSION OF REPORTS**

- A. Fill in test results on appropriate forms.

## **PART 4 - SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED**

### **4.01 GENERAL REQUIREMENTS**

- A. Title Page:
  - 1. Project name.
  - 2. Project location.
  - 3. Project Architect.
  - 4. Project Engineer (IMEG Corp.).
  - 5. Project General Contractor.
  - 6. TAB Company name, address, phone number.
  - 7. TAB Supervisor's name and certification number.
  - 8. TAB Supervisor's signature and date.
  - 9. Report date.
- B. Report Index

C. General Information:

1. Test conditions.
2. Nomenclature used throughout report.
3. Notable system characteristics/discrepancies from design.
4. Test standards followed.
5. Any deficiencies noted.
6. Quality assurance statement.

D. Instrument List:

1. Instrument.
2. Manufacturer, model, and serial number.
3. Range.
4. Calibration date.

**4.02 AIR SYSTEMS**

A. Air Moving Equipment:

1. General Requirements:
  - a. Drawing symbol.
  - b. Location.
  - c. Manufacturer, model, arrangement, class, discharge.
  - d. Fan RPM.
2. Flow Rate:
  - a. Supply flow rate (cfm): specified and actual.
  - b. Return flow rate (cfm): specified and actual.
  - c. Outside flow rate (cfm): specified and actual.
  - d. Exhaust flow rate (cfm): specified and actual.

B. Air Terminal (Inlet or Outlet):

1. Drawing symbol.
2. Room number/location.
3. Terminal type and size.
4. Velocity: specified and actual.
5. Flow rate (cfm): specified and actual.
6. Percent of design flow rate.

**END OF SECTION**

## SECTION 23 0713 - DUCTWORK INSULATION

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Ductwork Insulation.
- B. Insulation Jackets.

#### 1.02 QUALITY ASSURANCE

- A. Applicator: Company specializing in ductwork insulation application with five years minimum experience. When requested, installer shall submit manufacturer's certificate indicating qualifications.
- B. Materials:
  - 1. Listed and labeled for flame spread/smoke developed rating of no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.
  - 2. Fungal Resistance: No growth when tested in accordance with ASTM G21 (antifungal test).
  - 3. Rated velocity on coated air side for air erosion in accordance with UL 181 at 5,000 fpm minimum.
  - 4. UL listed in Category HNKT.
- C. Adhesives: UL listed, meeting NFPA 90A/90B requirements.

#### 1.03 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASTM C553 - Mineral Fiber Blanket and Felt Insulation.
- C. ANSI/ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
- D. ASTM E84 - Surface Burning Characteristics of Building Materials.
- E. ASTM E136 - Standard Test Method for the Behavior of Materials in a Vertical Tube Furnace at 750°C.
- F. ASTM E814 - Fire Tests of Through Penetrations Firestops.
- G. ASTM E2336-04 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.
- H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

- I. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.
- J. NFPA 96 - Standard for the Installation of Equipment for Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.
- K. NFPA 255 - Surface Burning Characteristics of Building Materials.
- L. UL - XHEZ - Through Penetration Firestop Systems.
- M. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.
- N. UL 263 - Full Scale External Fire Tests with Hose Stream.
- O. UL 723 - Surface Burning Characteristics of Building Materials.
- P. UL 1479 - Fire Tests of Through Penetrations Firestops.

#### **1.04 SUBMITTALS**

- A. Submit shop drawings per Section 23 0500. Include product description, list of materials and thickness for each service, and location.
- B. Submit manufacturer's installation instructions.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Type A: Flexible Fiberglass - Outside Wrap; ANSI/ASTM C553; commercial grade; 0.28 / 0.26 (Out-Of-Package/Installed-Compressed 25%) maximum 'K' value at 75°F; foil scrim Kraft facing, 1.0 lb./cu. ft. density. Submit both "Out of Package" and "Installed-Compressed 25%" K and R-values.
- B. Type B: Semi-rigid Fiberglass Board Wrap - Outside Application; ANSI/ASTM C612, Class 1; 0.25 maximum 'K' value at 75°F; foil scrim Kraft facing, 3 lb./cu. ft. density.
- C. Type C: Flexible Fiberglass Liner; ANSI/ASTM C1071; 0.28 maximum 'K' value at 75°F; 1.5 lb/cu ft minimum density; coated air side for 5000 fpm air velocity.
- D. Type E: Double wall ductwork insulation; fiberglass; 0.27 maximum 'K' value at 75°F mean temperature; 1.5 lb/cu ft density.

- E. Type F: Flexible High Temperature Wrap; ASTM E2336 rating as 2-hour separation with zero clearance to combustible materials over the full length. Material to be totally scrim encapsulated. Material to be a minimum 1-1/2" thick with a minimum core density of 6 pcf. Wrap system should offer zero clearance to combustibles per ASTM E2336 at all locations, comply with all applicable codes, and be approved by AHJ. If system is not rated for zero clearance per ASTM E2336 at all locations with single layer, a two-layer system shall be provided with zero clearance per ASTM E2336 at all locations. Material must be tested and listed for installation on grease ducts and installed per listed design. Refer to Section 23 3300 for prefabricated, pre-insulated access doors required for grease duct systems.

## **2.02 JACKETS**

- A. Vapor Barrier Jackets: Kraft reinforced foil scrim vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 25 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

## **2.03 JACKET COVERINGS**

- A. Aluminum Jackets: ASTM B209; 0.016" thick; smooth or embossed stucco finish with Z edge seams and aluminum bands for outdoor use. Where colored jacket covers are called for, provide factory-applied hard film acrylic paint in color selected by Architect.
- B. Stainless Steel Jackets: Type 304 stainless steel; 0.010" thick; smooth finish with Z edge seams and stainless steel bands for outdoor use.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install materials in accordance with manufacturer's instructions, codes, and industry standards.
- B. Install materials after ductwork has been tested.
- C. Clean surfaces for adhesives.
- D. Provide insulation with vapor barrier when air conveyed may be below ambient temperature.
- E. Exterior Duct Wrap - Flexible, Type A:
  - 1. Apply with edges tightly butted.
  - 2. Cut slightly longer than perimeter of duct to insure full thickness at corners. Do not wrap excessively tight.
  - 3. Seal joints with adhesive backed tape.
  - 4. Apply so insulation conforms uniformly and firmly to duct.
  - 5. Seal all penetrations of the vapor barrier by strap hangers or slip cable hangers with adhesive backed tape.

6. Provide high-density insulation inserts on rectangular ducts at trapeze duct hangers to prevent crushing of insulation. Provide high-density insulation inserts with clamp-on round ducts requiring two (2) rods or straps to prevent crushing of insulation. Maintain continuous vapor barrier through the hanger.
  7. Tape all joints with Royal Tapes #RT 350 (216-439-7229), Venture Tape 1525CW, or Compac Type FSK. No substitutions will be accepted without written permission from the Architect/Engineer.
  8. Press tape tightly to the duct covering with a squeegee for a tight continuous seal. Fish mouths and loose tape edges are not acceptable.
  9. Staples may be used, but must be covered with tape.
  10. Vapor barrier must be continuous.
  11. Mechanically fasten on 12" centers at bottom of ducts over 24" wide and on all sides of vertical ducts.
- F. Semi Rigid Fiberglass Board Wrap - Type B (Indoor Use):
1. Impale on pins welded to the duct and secured with speed clips. Clip pins off close to speed clips.
  2. Space pins as needed to hold insulation firmly against duct, but not less than one pin per square foot. Pins must be long enough to avoid compressing the insulation.
  3. Seal all joints and speed clips with glass fabric set in adhesive or a 3" wide strip of Royal Tapes #RT 350 (216-439-7229), Venture Tape 1525CW, or Compac Type FSK facing tape.
  4. For small areas, secure insulation with adhesive over the entire surface of the duct. Use adhesive in addition to pins as needed to prevent sagging on horizontal surfaces.
- G. Semi Rigid Fiberglass Board Wrap - Type B (Outdoor Use):
1. Impale on pins welded to the duct and secured with speed clips. Clip pins off close to speed clips.
  2. Space pins as required to hold insulation firmly against duct, but not less than one pin per square foot. Pins must be long enough to avoid compressing the insulation.
  3. Seal all joints and speed clips with glass fabric set in adhesive or a 3" wide strip of the same facing tape with adhesive.
  4. For small areas, secure insulation with adhesive over the entire surface of the duct. Use adhesive in addition to pins as needed to prevent sagging on horizontal surfaces.
  5. Install vapor barrier jacket. Cover with aluminum jacket covering with seams on the bottom of horizontal ductwork.
  6. Seal all butt joints with metal draw bands screwed to jacket and filled with sealant. Seal all joints watertight.
  7. Provide positive slope on top of all horizontal surfaces to prevent ponding of water.
- H. Interior Insulation - Flexible Duct Liner, Type C:
1. Observation of Duct Lining:
    - a. After installation of ductwork, Architect/Engineer may select random observation points in each system.
      - 1) At each observation point, cut and remove an 18" x 18" section of ductwork and liner for verification of installation.
      - 2) Random observation points based on one opening per 75 lineal ft. of total duct run.

- b. When any of the observation points shows non-compliance, additional points will be designated by the Architect/Engineer, and observation repeated.
  - c. If 20% of points observed do not comply, remove and replace all lined ducts and repeat tests. Where replacement is not required, correct all non-compliances.
  - d. At end of observation, repair all duct lining and observation holes by installing standard, insulated, hinged access doors per Section 23 3300.
  - e. Paint or finish to match adjacent duct surfaces.
2. Impale on spindle anchors welded or mechanically fastened to the duct. Adhesive or glue fastened anchors are not acceptable. Maximum anchor spacing per SMACNA Duct Construction Standards or manufacturer's recommendations, whichever is more restrictive. Locate pins less than 3" from corners and at intervals not over 6" around the perimeter at leading and trailing edges. Locate pins within 3" of transverse joints and at intervals not over 16" long the length of the duct. Pins must be long enough to prevent compressing the insulation.
  3. In addition to anchors, secure liner with UL listed adhesive covering over 90% of the duct surface.
  4. Install per the latest edition of the SMACNA Manual.
  5. Leading edges shall be covered as follows:
    - a. For duct velocities below 3000 fpm, coat leading edges with adhesive. Neatly butt liner without gaps at transverse joints. Cut liner flush with end of the duct section for tight joints with no exposed duct. If adhesive is shop installed, field apply additional adhesive to the end of each duct section for complete adhesion of the liner. Protect edges from dirt and debris.
    - b. For duct velocities above 3000 fpm, cover leading edges with metal nosing. Use nosing on upstream edges of each section of duct. If the duct can be installed in either direction, provide nosing on each end or clearly mark the duct to allow visual verification after installation. Verify duct velocities based on the scheduled air flow rates and determine where metal nosing is required.
    - c. Install metal nosing in the following locations (regardless of velocity):
      - 1) The first three fittings downstream of all fans.
      - 2) At all duct liner interruptions. This includes fire dampers, access doors, branch connections, and all other locations where the edge of the liner is exposed.
      - 3) Trailing edges of transverse joints do not require metal nosings.
  6. Overlap liner at longitudinal joints. Make longitudinal joints at corners of the duct unless the duct size does not allow this. Coat longitudinal joints with adhesive at velocities over 2500 fpm.
  7. Seal all damaged duct liner with adhesive and glass cloth. Do not damage duct liner surface coatings.
  8. Duct dimensions given are net inside dimensions. Increase sheet metal to allow for insulation thickness.
- I. Double-Wall Ductwork Insulation - Type E:
1. Install insulation per manufacturer's recommendations.
  2. Duct dimensions given are net inside dimensions of inner wall.
- J. Preformed Fiberglass Acoustical Liner, Rigid - Type G:



1. Cut and secure duct liner inside duct.
2. Install insulation pins or adhesives in locations as recommended by the manufacturer.
3. Seal all damaged duct liner and fill all gaps with manufacturer approved sealant. Do not damage duct liner surface coatings.
4. Where edges show evidence of delamination, the damaged areas shall be secured by manufacturer approved sealant.
5. Duct dimensions given are net inside dimensions. Increase sheet metal to allow for insulation thickness.

K. Continue insulation with vapor barrier through penetrations unless code prohibits.

L. Provide 2" wide, 24" high, 26 gauge, galvanized sheet metal corner protection angles for all externally insulated ductwork extending to a floor or curb.

### **3.02 SCHEDULE**

A. Refer to Section 23 3100 for scheduling of insulation.

**END OF SECTION**

## SECTION 23 0719 - HVAC PIPING INSULATION

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Piping Insulation.
- B. Insulation Jackets.

#### 1.02 QUALITY ASSURANCE

- A. Applicator: Company specializing in piping insulation application with five years minimum experience.
- B. Materials: Listed and labeled for flame spread/smoke developed rating of no more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
- C. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

#### 1.03 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASTM C195 - Mineral Fiber Thermal Insulation Cement.
- C. ANSI/ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- D. ANSI/ASTM C534 - Elastomeric Foam Insulation.
- E. ANSI/ASTM C547 - Mineral Fiber Preformed Pipe Insulation.
- F. ANSI/ASTM C552 - Cellular Glass Block and Pipe Thermal Insulation.
- G. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.
- H. ASTM C591 - Unfaced Preformed Rigid Cellular Polyisocyanurate Insulation.
- I. ASTM C578 - Preformed Cellular Polystyrene Thermal Insulation.

- J. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
- K. ASTM C1729 - Standard Specification for Aluminum Jacketing for Insulation.
- L. ASTM C1767 - Standard Specification for Stainless Steel Jacketing for Insulation.
- M. ASTM E84 - Surface Burning Characteristics of Building Materials.
- N. NFPA 255 - Surface Burning Characteristics of Building Materials.
- O. UL 723 - Surface Burning Characteristics of Building Materials.
- P. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

## **PART 2 - PRODUCTS**

### **2.01 INSULATION**

- A. Type B: Flexible elastomeric foam insulation; closed-cell, sponge or expanded rubber (polyethylene type is not permitted); ANSI/ASTM C534, Grade 1 Type I for tubular materials; flexible plastic; 0.25 maximum 'K' value at 75°F, listed and labeled at more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Maximum 1" thick per layer where multiple layers are specified.
- B. Type C: Molded rigid cellular glass; ANSI/ASTM C-552; 0.29 maximum 'K' value at 75°F; density 7.3lb/ft; minimum compressive strength 90 psi parallel to rise; moisture resistant, non-combustible; suitable for -100°F to +900°F. For below grade installations use asphaltic mastic paper vapor barrier jacket. Use self-seal all-purpose polymer or polypropylene service jacket for above grade installations.
- C. Type D: Hydrous Calcium Silicate; ASTM C533; rigid molded pipe insulation; asbestos free; 0.40 'K' value at 300°F; 1200°F maximum service temperature; 16 gauge stainless steel tie wires on maximum 12" centers.

### **2.02 VAPOR BARRIER JACKETS**

- A. All-purpose polymer or polypropylene service jacket vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.
- B. Polyvinylidene Chloride (PVDC or Saran) film and tape: Durable and highly moisture and moisture vapor resistant. Please refer to manufacturer's recommended installation guidelines.

## **2.03 JACKET COVERINGS**

- A. Aluminum Jackets: ASTM C1729; 0.016" thick (thicker where required by ASTM C1729); stucco embossed finish with Z edge seams and aluminum bands for outdoor use. Where colored jacket covers are called for, provide factory-applied hard film acrylic paint in color selected by Architect.

## **2.04 REMOVABLE INSULATION JACKETS**

- A. Removable insulation jackets shall consist of outer covering, interstitial insulation material, and inner covering.
- B. Inner and outer covering shall be constructed from a minimum 16.5 oz./yd<sup>2</sup> PTFE fiberglass composite and suitable for insulating surface temperatures up to 550°F.
- C. Interstitial insulation blanket shall be minimum 1-1/2" thick and shall consist of either:
  - 1. Silica and glass-fiber insulation felts and blankets - minimum 6 lb./ft<sup>3</sup> density.
  - 2. E-type glass-fiber felts and blankets - minimum 6 lb./ft<sup>3</sup> density.
- D. Construction: Inner and outer covering with interstitial insulation material shall be joined into a single assembly using a double sewn lock stitch with 4-6 stitches/inch. The thread used shall be able to withstand minimum 550°F surface temperatures without degradation. The use of hog rings, staples, and wires for closure of assembly are not acceptable. The interstitial insulation shall be sewn as an integral part of the inner and outer coverings to prevent shifting of the insulation. Insulation pins are not an allowable method of preventing the insulation from shifting and shall not be used.
- E. No raw cut jacket edges shall be exposed.
- F. Jackets shall be fastened to equipment and piping components using hook and loop (Velcro) straps and minimum 1" slide buckles.
- G. Jacket coverings shall have an inner covering edge with a continuous strip of hook & loop closure (Velcro) that is parallel to the seam and overlaps the outer covering by a minimum of 2 inches.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.
- B. Patch and repair torn insulation. Paint to match adjacent insulation surface.

### **3.02 INSTALLATION**

- A. General Installation Requirements:
  - 1. Install materials per manufacturer's instructions, building codes and industry standards.

2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.
  3. All piping and insulation that does not meet 25/50 that is in an air plenum shall have written approval from the Authority Having Jurisdiction and the local fire department for authorization and materials approval. If approval has been allowed, the non-rated material shall be wrapped with a product that has been listed and labeled having a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested as a composite in accordance with ASTM E84 or UL 723.
  4. On 1" and smaller piping routed through metal wall studs, provide a plastic grommet to protect the piping. The piping shall be insulated between the wall studs, and the insulation shall butt up to each stud.
- B. Insulated Piping Operating Below 60°F:
1. Insulate fittings, valves, unions, flanges, flexible connections, flexible hoses, and expansion joints. Seal all penetrations of vapor barrier.
  2. All balance valves and strainers with fluid operating below 60°F shall be insulated with a removable plug wrapped with vapor barrier tape to allow access for reading and adjusting of the balancing valve and cleaning and servicing of the balancing valve.
- C. Insulated Piping Operating Between 60°F and 140°F:
1. Do not insulate flanges and unions, but bevel and seal ends of insulation at such locations. Insulate all fittings, valves and strainers.
- D. Insulated Piping Operating Above 140°F:
1. Insulate fittings, valves, flanges, float & thermostatic steam traps, and strainers. On gate valves, the insulation shall be extended to cover the entire valve bonnet, leaving only the portion of the stem that is above the bonnet and valve operator exposed.
  2. All balance valves with fluid operating above 140°F shall be insulated and an opening shall be left in the insulation to allow for reading and adjusting the valve.
  3. The use of removable insulation jackets is acceptable for insulating large and non-cylindrical shaped piping components (e.g., check valves, pressure regulating valves, calibrated balance valves, gate valve bonnets, F&T traps, strainers, line sets, and the like).
- E. Refrigerant Piping:
1. On refrigerant piping (25°F and above) and not required to meet the 25/50 flame/smoke, provide at each strut or clevis support an insulation coupling to support pipe and to accept insulation thickness of adjoining insulation, to prevent insulation from sagging and crushing. The coupling shall be suitable for planned temperatures, use with specified pipe material, and shall be a 360°, one-piece cylindrical segment. Use mechanical fasteners where coupling cannot be installed on pipe during installation. Contractor shall apply adhesive to ends of insulation entering insulation coupling to maintain vapor barrier.
- F. Exposed Piping:
1. Locate and cover seams in least visible locations.
  2. Where exposed insulated piping extends above the floor, provide a sheet metal guard around the insulation extending 12" above the floor. Guard shall be 0.016" cylindrical smooth or stucco aluminum and shall fit tightly to the insulation.

### 3.03 SUPPORT PROTECTION

- A. Provide a shield on all insulated piping at each support between the insulation jacket and the support.
- B. On all insulated piping greater than 1-1/2", provide shield with insulation insert of same thickness and contour as adjoining insulation at each support, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Inserts shall be as follows:
  - 1. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a minimum 180° cylindrical segment the same length as metal shields. Inserts shall be:
    - a. Molded hydrous calcium silicate (only use for pipes with operating temperatures above 90°F, with a minimum compressive strength of 100 psi is acceptable for pipe sizes 14" and below. For pipe sizes larger than 14", provide rolled steel plate in addition to the shield.
    - b. As an alternative to separate pipe insulation insert and saddle, properly sized manufactured integral rigid insulation insert and shield assemblies may be used.
      - 1) Products:
        - a) Buckaroo CoolDry
        - b) Cooper/B-Line Fig. B3380 through B3384
        - c) Pipe Shields A1000, A2000
      - c. Insulation Couplings:
        - 1) Molded thermoplastic slip coupling, -65°F to 275°F, sizes up to 4-1/8" OD, and receive insulation thickness up to 1". Suitable for use indoors or outdoors with UV stabilizers. Vertical insulation riser clamps shall have a 1,000lb vertical load rating. On cold pipes operating below 60°F, cover joint and coupling with vapor barrier mastic to ensure continuous vapor barrier.
        - 2) Horizontal Strut Mounted Insulated Pipe Manufacturers:
          - a) Klo-Shure or equal
        - 3) Vertical Manufacturers:
          - a) Manufacturers: Klo-Shure Titan or equal
      - d. Rectangular blocks, plugs, or wood material are not acceptable.
      - e. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.
- C. Neatly finish insulation at supports, protrusions, and interruptions.

D. Install metal shields between all hangers or supports and the pipe insulation. Shields shall be galvanized sheet metal, half-round with flared edges. Adhere shields to insulation. On cold piping, seal the shields vapor-tight to the insulation as required to maintain the vapor barrier, or add separate vapor barrier jacket.

E. Shields shall be at least the following lengths and gauges:

Pipe Size	Shield Size
1/2" to 3-1/2"	12" long x 18 gauge
4"	12" long x 16 gauge
5" to 6"	18" long x 16 gauge
8" to 14"	24" long x 14 gauge
16" to 24"	24" long x 12 gauge

F. Ferrous hot piping 4 inches and larger, provide steel saddle at rollers as described in Section 23 0529 "HVAC Supports and Anchors".

G. Minimum 1/4" rolled galvanized steel plates shall be provided in addition to the sleeves as reinforcement on large pipes to reduce point loading on roller, trapeze hanger and strut support locations depending on insulation compressive strength. Refer to section above for exact locations.

### 3.04 INSULATION

A. Type A Insulation:

1. All Service Jackets: Seal all longitudinal joints with self-seal laps using a single pressure sensitive adhesive system. Do not staple.
2. Insulation without self-seal lap may be used if installed with Benjamin Foster 85-20 or equivalent Chicago Mastic, 3M or Childers lap adhesive.
3. Apply insulation with laps on top of pipe.
4. Fittings, Valve Bodies and Flanges: For 4" and smaller pipes, insulate with 1 lb. density insulation wrapped under compression to a thickness equal to the adjacent pipe insulation. For pipes over 4", use mitered segments of pipe insulation. Finish with preformed plastic fitting covers. Secure fitting covers with pressure sensitive tape at each end. Overlap tape at least 2" on itself. For pipes operating below 60°F, seal fitting covers with vapor retarder mastic in addition to tape.

B. Type B Insulation:

1. Install per manufacturer's instructions or ASTM C1710.
2. Elastomeric Cellular Foam: Where possible, slip insulation over the open end of pipe without slitting. Seal all butt ends, longitudinal seams, and fittings with adhesive. At elbows and tees, use mitered connections. Do not compress or crush insulation at cemented joints. Joints shall be sealed completely and not pucker or wrinkle. Paint the outside of outdoor insulation with two coats of latex enamel paint recommended by the manufacturer.
3. Insulation Installation on Straight Pipes and Tubes:

- a. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
  - b. Insulation must be installed in compression to allow for expansion and contraction. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
- 4. Insulation Installation on Valves and Pipe Specialties:
  - a. Install preformed sections of same material as straight segments of pipe insulation when available.
  - b. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  - c. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- C. Type C Insulation:
  - 1. Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner.
  - 2. Insulate fittings with prefabricated fittings.
- D. Type D Insulation:
  - 1. Use pre-molded half sections. Butt longitudinal and circumferential joints tightly. Wire in place with 16 gauge stainless steel wire on maximum 12" centers.
  - 2. Apply in two layers. Stagger all joints between layers. Wire each layer individually.
- E. Type E Insulation:
  - 1. Indoors, above grade or below grade, Polyvinylidene chloride (PVDC or Saran) vapor retarder film and tape: Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner. Refer to manufacturer's recommendations for installation guidelines.
  - 2. Insulate pipe fittings with prefabricated insulation fittings.
- F. Type F Insulation:
  - 1. Seal all longitudinal joints with manufacturer approved adhesive or mastic. Secure butt joint strips in a similar manner.
  - 2. Indoors, above grade or below grade, polyvinylidene chloride (PVDC or Saran) vapor retarder film and tape: Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner. Refer to manufacturer's recommendations for installation guidelines.
  - 3. Insulate pipe fittings with prefabricated insulation fittings.
- G. Type G Insulation:
  - 1. Outdoor and Indoor, Underground: Compact insulation per manufacturer's requirements to allow insulation to act as pipe bedding. Install padding at expansion loops or elbows.
  - 2. Manufacturer's representative shall visit site and approve installation procedures.
- 3. Thickness listed is nominal. Follow manufacturer's guidelines for actual dimensions.



H. Type H, I, and J Insulation:

1. Apply with edges tightly butted, joints broken.
2. Secure with 16 gauge galvanized, annealed steel wire or 1/2" x 0.015" galvanized steel bands, 12" maximum centers.
3. Install welding studs, clips and angles where required to anchor wires and bands.

I. Type K Insulation:

1. Indoors, above grade, Polyvinylidene chloride (PVDC or Saran) vapor retarder film and tape: Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner. Refer to manufacturer's recommendations for installation guidelines.
2. Insulate fittings with prefabricated fittings.

J. Type L Insulation:

1. Aerogel Blanket: Apply in multiple layers. Either a butt joint or lap joint is acceptable for the longitudinal seam. Stagger all joints between layers.
2. Each layer may be held in place using tape, wire, adhesive spray, or banding. The use of tape and spray adhesives is not permitted. Install metal cladding in typical fashion and seal.
3. Elbow Fittings: Provide manufacturer's single-piece elbow fittings and apply as many layers as required to meet the minimum insulation thickness requirements, or, Contractor may cut the insulation blanket in a gore pattern per the manufacturer's recommendation and apply to the elbow in layers, staggering the seams where possible. Reference manufacturer's cutting charts for proper size and pattern of cuts for pipe fittings.

### 3.05 JACKET COVER INSTALLATION

A. Metal Covering:

1. Provide vapor barrier as specified for insulation type. Cover with jacket covering with seams located on the bottom of horizontal piping. Include fittings, joints and valves.
2. Seal all interior and exterior butt joints with metal draw bands and sealant. Seal all exterior joints watertight.
3. Interior joints do not need to be sealed.
4. Use metal covering on the following pipes:
  - a. All exterior piping.
  - b. All exposed piping in finished spaces.
  - c. All exposed piping in areas noted on drawings.
5. Use colored aluminum jacket covers on the following pipes:
  - a. All exterior piping.

**END OF SECTION**

## SECTION 23 0801 - COMMISSIONING OF HVAC

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Description
- B. Responsibilities
- C. Related Work
- D. Test Equipment

#### 1.02 DESCRIPTION

- A. The purpose of this section is to specify Division 23 responsibilities in the commissioning process.
- B. The systems to be commissioned are the building mechanical systems in IECC 2018 Section C408 applicable to the project.
  - 1. AHU
  - 2. RTU
  - 3. Air Terminal Box
  - 4. Fan Powered Air Terminal Box
- C.

#### 1.03 RESPONSIBILITIES

- A. Commissioning requires the participation of the Division 23 Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 01 9101. Division 23 Contractor shall be familiar with all parts of Section 01 9101 and shall execute all commissioning responsibilities assigned to them in the Contract Documents.
- B. Refer to Section 01 9101 for more information.

#### 1.04 RELATED WORK

- A. Specific commissioning requirements are given in the following sections of these specifications. All the following sections apply to the Work of this section.
  - 1. Section 01 7823 - Operations and Maintenance
  - 2. Section 01 7900 - Demonstration and Training
  - 3. Section 01 9101 - Commissioning
  - 4. Section 22 0801 - Commissioning of Plumbing
  - 5. Section 26 0801 - Commissioning of Electrical

## **PART 2 - PRODUCTS**

### **2.01 TEST EQUIPMENT**

- A. The Contractor shall provide all test equipment necessary to fulfill the testing requirements of this Division. This equipment includes, but is not limited to, the following:
  - 1. Handheld temperature and relative humidity meter.
  - 2. Infrared thermometer gun.
  - 3. Analog differential pressure gauge and associated tubing.
  - 4. Portable computer with access to the building automation system.
- B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the related specifications. If not otherwise noted, the following minimum requirements apply:
  - 1. Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of +/- 0.1°F.
  - 2. Pressure sensors shall have an accuracy of +/- 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.
  - 3. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.
- C. Refer to Section 01 9101 for additional Division 23 requirements.

## **PART 3 - EXECUTION**

- A. Refer to Section 01 9101 for more information.

**END OF SECTION**

## SECTION 23 0905 - SMALL EQUIPMENT CONTROLS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Complete System of Automatic Controls.
- B. Control Devices, Components, Wiring and Material.
- C. Instructions for Owners.

#### 1.02 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years' experience.
- B. TCC: Company specializing in the work of this section with minimum three years temperature control experience.
- C. Technician: Minimum three years' experience installing commercial temperature control systems.
- D. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under this section.

#### 1.03 REFERENCES

- A. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ANSI/ASHRAE Standard 135-2016: BACnet® - A Data Communication Protocol for Building Automation and Control Networks, including all amendments.
- D. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 volts Maximum).
- E. ANSI/NFPA 70 - National Electrical Code.
- F. ANSI/NFPA 90A - Installation of Air-Conditioning and Ventilation Systems.
- G. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
- H. ASHRAE 85 - Automatic Control Terminology for Heating, Ventilating, Air Conditioning.
- I. IEEE 802.15.4 - Standard for Low Rate Wireless Networks

## 1.04 SUBMITTALS

### A. Equipment Coordination:

1. The Mechanical Contractor shall obtain approved equipment submittals from other contractors to determine equipment wiring connections, to choose appropriate controllers, and to provide programming.
2. Coordinate the control interface of all equipment with the equipment manufacturers prior to submittal submission.

### B. Operation and Maintenance Manual:

1. In addition to the requirements of Section 23 0500, submit an electronic copy of the O&M manuals in PDF format.
2. Provide three complete sets of manuals.
3. Each O&M manual shall include:
  - a. Table of contents with indexed tabs dividing information as outlined below.
  - b. Definitions: List of all abbreviations and technical terms with definitions.
  - c. Warranty Contacts: Names, addresses, and 24-hour telephone numbers of contractors installing equipment and controls and service representatives of each.
  - d. Licenses, Guarantees, and Warranties: Provide documentation for all equipment and systems.
  - e. System Components: Alphabetical list of all system components, with the name, address, and telephone number of the vendor.
  - f. Operating Procedures: Include procedures for operating the control systems; logging on/off; enabling, assigning, and reporting alarms; generating reports; collection, displaying, and archiving of trended data; overriding computer control; event scheduling; backing up software and data files; and changing setpoints and other variables.
  - g. Programming: Description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point database creation and modification, program creation and modification, and use of the editor.
  - h. Engineering, Installation, and Maintenance: Explain how to design and install new points, panels, and other hardware; recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions; how to debug hardware problems; and how to repair or replace hardware. A list of recommended spare parts.
  - i. Original Software: Complete original issue CDs for all software provided, including operating systems, programming language, operator workstation software, and graphics software. In lieu of CDs, provide login information and access to a web application where the current information can be downloaded at no additional cost.

### C. Training Manual:

1. Provide a course outline and training manuals for each training class. Provide login information and access to a web application where the current training manuals can be downloaded at no additional cost.

### D. Record Documents:

1. Submit record documentation per Section 23 0500.

2. Provide a complete set of "as-built" drawings and application software on CDs. Provide drawings as AutoCAD™ or Visio™ compatible files. Provide two copies of the "as-built" drawings with revisions clearly indicated in addition to the documents on compact disk. Provide all product data sheets in PDF format.
3. Submit two hard copies and one electronic copy of as-built versions of the shop drawings, including product data and record drawings with revisions clearly indicated. Provide floor plans showing actual locations of control components including panels, thermostats, sensors, and hardware.
4. Provide all completed testing and commissioning reports and checklists.
5. Submit printouts of all graphic screens with current values (temperatures, pressures, etc.) to the A/E verifying completion and proper operation of all points.

#### **1.05 DELIVERY, STORAGE AND HANDLING**

- A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.
- B. Factory-Mounted Components: Where control devices specified in this section are indicated to be factory mounted on equipment, arrange for shipping control devices to unit manufacturer.

#### **1.06 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION**

- A. Automatic Dampers.

#### **1.07 AGENCY AND CODE APPROVALS**

- A. All products shall have the following agency approvals. Provide verification that the approvals exist for all submitted products with the submittal package.
  1. UL-916; Energy Management Systems.
  2. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 "Signal Equipment."
  3. EMC Directive 89/336/EEC (European CE Mark).
  4. FCC, Part 15, Subpart J, Class A Computing Devices.

#### **1.08 ACRONYMS**

- A. Acronyms used in this specification are as follows:
  1. B-AAC - BACnet Advanced Application Controller
  2. B-ASC - BACnet Application Specific Controller
  3. BTL - BACnet Testing Laboratories
  4. DDC - Direct Digital Controls
  5. FMCS - Facility Management and Control System
  6. GUI - Graphic User Interface
  7. IBC - Interoperable BACnet Controller
  8. IDC - Interoperable Digital Controller
  9. LAN - Local Area Network
  10. NAC - Network Area Controller
  11. ODBC - Open DataBase Connectivity
  12. WNAC - Wireless Network Area Controller
  13. OOT - Object Oriented Technology
  14. OPC - Open Connectivity via Open Standards

15. PICS - Product Interoperability Compliance Statement
16. TCC - Temperature Control Contractor
17. TCS - Temperature Control System
18. WAN - Wide Area Network
19. WBI - Web Browser Interface

#### **1.09 SYSTEM DESCRIPTION**

- A. The entire TCS shall be comprised of a network of interoperable, standalone digital controllers communicating via the following protocol to an NAC. Temperature Control System products shall be as specified below.
- B. Provide materials and labor necessary to connect factory-supplied control components.
- C. Provide central and remote hardware, software, and interconnecting wire and conduit where required.

#### **1.10 SOFTWARE LICENSE AGREEMENT**

- A. The Owner shall be the named license holder of all software and applications associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job-specific configuration documentation, data files, configuration tools, and application-level software developed for the project. This shall include, but is not limited to, all custom, job-specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN/WAN/intranet and/or Internet connected routers and devices. Provide the Owner with all required IDs and passwords for access to any component or software program. The Owner shall determine which organizations shall be named in the SI organization ID ("orgid") of all software licenses. Owner shall be free to direct the modification of the "orgid" in any software license, regardless of supplier.

#### **1.11 JOB CONDITIONS**

- A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It is this Contractor's responsibility to check the Contract Documents for possible conflicts between the Work of this section and that of other crafts in equipment location; pipe, duct and conduit runs; electrical outlets and fixtures; air diffusers; and structural and architectural features.

#### **1.12 WARRANTY**

- A. Refer to Section 23 0500 for warranty requirements.
- B. Within the warranty period, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this Contractor at no expense to the Owner.
- C. Warranty requirements include furnishing and installing all FMCS software upgrades issued by the manufacturer during the one-year warranty period.
- D. Update all software and back-ups during warranty period and all user documentation on the Owner's archived software disks.

### 1.13 WARRANTY ACCESS

- A. The Owner shall grant to this Contractor reasonable access to the TCS and FMCS during the warranty period.

## PART 2 - PRODUCTS

### 2.01 DAMPER ACTUATORS

- A. Damper Actuators - Electronic:
  - 1. Actuator shall be UL 873 or 60730 listed and provided with NEMA housing for applicable environment, electronic overload protection to prevent actuator damage due to over-rotation. Mount actuator by means of a V-bolt dual nut clamp with a V-shaped toothed cradle, directly couple and mount to the valve bonnet stem, or ISO-style direct-coupled mounting pad. Actuators shall be capable of being mechanically and electrically paralleled to increase torque, if required.
  - 2. Actuators shall be warranted for a period of five (5) years from the date of production, with the first two (2) years unconditional.
  - 3. Proportional actuator position shall be proportional to analog or pulse width modulating signal from electronic control system.
  - 4. Fail-Safe Dampers: Where shown on the drawings or sequences, fail-safe mechanism shall operate the damper to the fail position following power interruption.
    - a. Mechanical/Spring: Mechanical spring return mechanism to drive controlled drive to an end position (open or close) on loss of power.
    - b. Electronic: Electronic fail-safe shall incorporate an active balancing circuit to maintain equal charging rates among the capacitors. The power fail position shall be proportionally adjustable between 0 to 100% in 10 percent increments with a 10 second operational delay.
  - 5. Feedback: Where shown on drawings or sequences, provide analog feedback signal for positive position indication.
  - 6. Damper End Switches: Where shown on the drawings or sequences, provide end switches to prove damper reaches open/closed position.

### 2.02 ZONE SENSORS

- A. Temperature Sensors:
  - 1. Room Temperature Sensor:
    - a. Sensor Only: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range,  $\pm 0.50^\circ\text{F}$  accuracy, no setpoint adjustment or override button.
    - b. Sensor with Setpoint Adjustment: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range,  $\pm 0.50^\circ\text{F}$  accuracy, with exposed single setpoint adjustment (no numeric temperature scale - provide with a single warmer/cooler or red/blue visual scale), no override button.



- c. Sensor with Override: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range,  $\pm 0.50^\circ\text{F}$  accuracy, occupied/unoccupied override button with LED, no setpoint adjustment.
- d. Sensor with Setpoint Adjustment and Override: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range,  $\pm 0.50^\circ\text{F}$  accuracy, with exposed single setpoint adjustment (no numeric temperature scale - provide with a warmer/cooler or red/blue visual scale), occupied/unoccupied override button with LED.
- e. Sensors shall include the following functions:
  - 1) A signal strength on the space sensor display.
  - 2) Error codes shall be displayed on the digital display. Error codes shall include: not associated, address to 000, improper software configuration, input voltage too high, or general sensor failure. Codes shall be indicated on inside of sensor back cover.
  - 3) Provide an LCD display readable in low light conditions, and text display shall be a minimum font size of 12 points.
  - 4) Space/wall sensors shall be supplied with power harvesting capabilities to supplement battery life.

B. Miscellaneous Devices:

1. Thermostat and Sensor Enclosures:

- a. Clear plastic guard with lock. Wire guard with tamperproof screws. Setpoint shall be adjustable with cover in place. Fasten to wall separately from thermostat. Provide guards in all corridors, gymnasiums, locker rooms, toilet rooms, assembly halls and as noted on the drawings.
- b. Heavy Duty Enclosure:
  - 1) Perforated steel, tamperproof locking thermostat and control device enclosure.
  - 2) Box shall be nominally 8"x6"x2" deep or sized as required to fit devices to be enclosed.
  - 3) Perforated cover shall be 16 gauge steel with maximum 3/16" perforations on maximum 1/4" staggered centers for a 55% free area.
  - 4) Secure to wall from inside of box. Cover shall be secured by tamperproof screws to frame.
  - 5) Color shall match electrical devices. Verify color with the Electrical Contractor.

**2.03 CONDUIT AND BOXES**

A. Conduit and Boxes: Refer to Electrical Section 26 0533 for materials, sizing, and other requirements

B. Conduit and Box Identification (Color and Labeling):

- 1. Refer to the Temperature Control Contractor notes located on the mechanical cover sheet for raceway and box color requirements.
- 2. Refer to Electrical Section 26 0553 for raceway and box labeling requirements.

## **2.04 SEQUENCE OF OPERATION (PRESCRIPTIVE)**

- A. The following items are prescriptive sequences. Refer to the drawings for the complete sequence of operations.
- B. System Operating Modes: The system controller shall send the equipment controllers Occupied/Unoccupied, Morning Warm-up/Pre-cool, and Heat/Cool modes. If communication is lost, the equipment controllers shall operate using default modes and setpoints.
  - 1. Night Setback: During unoccupied mode, the system shall shut off. If the zone temperature drifts to the unoccupied heating or cooling setpoint, the system shall start up to heat or cool the zone while the OA damper remains closed (unless economizing).
  - 2. Optimal Start: The system controller shall automatically determine the optimal start time such that each zone reaches its occupied setpoint just in time for scheduled occupancy.
  - 3. Demand Controlled Ventilation: For those zones equipped with an occupancy sensor or CO2 sensor, outdoor airflow shall be reset based on occupancy status and/or measured CO2 concentration.
- C. Single-Zone Constant Volume System:
  - 1. Occupied Heat/Cool: The RTU shall operate the supply fan continuously and modulate (or cycle) compressors, modulate (or stage) heat, and/or enable airside economizing to maintain zone temperature at setpoint. The OA damper shall open to bring in the required amount of ventilation.
  - 2. Morning Warm-Up/Pre-Cool: The RTU shall operate the supply fan and modulate (or cycle) compressors or modulate (or stage) heat to raise/lower zone temperature to its occupied setpoint. The OA damper shall remain closed, unless economizing.

## **PART 3 - EXECUTION**

### **3.01 GENERAL INSTALLATION**

- A. Verify that systems are ready to receive work. Beginning of installation means installer accepts existing conditions.
- B. Install system and materials in accordance with manufacturer's instructions.
- C. Drawings of the TCS and FMCS network are diagrammatic only. Any apparatus not shown but required to meet the intent of the project documents shall be furnished and installed without additional cost.
- D. Install all operators, sensors, and control devices where accessible for service, adjustment, calibration, and repair. Do not install devices where blocked by piping or ductwork. Devices with manual reset or limit adjustments shall be installed below 6'-0" if practical to allow inspection without using a ladder.
- E. Verify locations of wall-mounted devices (such as thermostats, temperature and humidity sensors, and other exposed sensors) with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Maximum height above finished floor shall not exceed 48".
- F. After completion of installation, test and adjust control equipment.

- G. Check calibration of instruments. Recalibrate or replace.
- H. Furnish and install conduit, wire, and cable per the National Electric Code, unless noted otherwise in this section. All hardware, software, equipment, accessories, wiring (power and sensor), relays, sensors, power supplies, transformers, and instrumentation required for a complete and operational FMCS system, but not shown on the electrical drawings, are the responsibility of the TCC.
- I. Labels For Control Devices:
  - 1. Provide labels indicating service of all control devices in panels and other locations.
  - 2. Labels may be made with permanent marking pen in the control panels if clearly legible.

### **3.02 FMCS INSTALLATION**

- A. Coordinate voltage and ampacity of all contacts, relays, and terminal connections of equipment being monitored or controlled. Voltage and ampacity shall be compatible with equipment voltage and be rated for full ampacity of wiring or overcurrent protection of circuit controlled.
- B. Naming Conventions: Coordinate all point naming conventions with Owner standards. In the absence of Owner standards, naming conventions shall use equipment designations shown on plans.

### **3.03 COMMISSIONING**

- A. Upon completion of the installation, this Contractor shall load all system software and start up the system. This Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to ensure that the system is functioning in full accordance with these specifications.
- B. This Contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the FMCS system operation. Test shall include onsite testing to verify each wireless device is responding to signals from other wireless devices and the cloud-based server without interruption.
- C. This Contractor shall prove that the controls network is functioning correctly and within acceptable bandwidth criteria and shall test the system with an approved protocol analysis tool. Provide a log and statistics summary showing that each channel is within acceptable parameters. Each channel shall be shown to have at least 25% spare capacity for future expansion.
- D. Upon completion of the performance tests described above, repeat these tests, point by point, as described in the validation log above in the presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.
- E. System Acceptance: Satisfactory completion is when this Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

### **3.04 PREPARATION FOR BALANCING**

- A. Verify that all dampers are in the position indicated by the controller (e.g., open, closed or modulating).
- B. Check the calibration and setpoints of all controllers.
- C. Check the locations of all thermostats for potential erratic operation from outside influences such as sunlight, drafts, or cold walls.

### **3.05 TEST AND BALANCE COORDINATION**

- A. The Contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
- B. The tools used during the test and balance process shall be returned at the completion of the testing and balancing.

### **3.06 DEMONSTRATION AND ACCEPTANCE**

- A. At completion of installation, provide four hours minimum instruction for operators. Demonstrate operation of all controls and systems. Describe the normal operation of all equipment.

### **3.07 INSTALLATION OF SENSORS**

- A. Install sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for the environment within which the sensor operates.
- C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
- D. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
- E. Averaging sensors and low limits shall be installed at the top of the assembly with the element on a slight downward incline away from the sensor making a serpentine pattern over the cross-sectional area with elements spaced not over 12" apart and within 6" of the top and bottom of the area.
- F. Install outdoor air temperature sensors on exterior of north wall, complete with sun shield at designated location approved by Architect/Engineer. TCC shall prime and paint the device enclosure. Color selection by Architect.

**END OF SECTION**

## SECTION 232300 - REFRIGERATION PIPING AND SPECIALTIES

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Piping and Pipe Fittings
- B. Moisture and Liquid Indicators
- C. Check Valves
- D. Pressure Relief Valves
- E. Filter-Driers
- F. Suction Filters
- G. Solenoid Valves
- H. Expansion Valves
- I. Receivers
- J. Suction Accumulators

#### 1.02 QUALITY ASSURANCE

- A. Remanufactured specialties are not acceptable.

#### 1.03 REFERENCES

- A. ANSI/ASME SEC 8D - Boilers and Pressure Vessels Code, Rules for Construction of Pressure Vessels.
- B. ANSI/ASME SEC 9 - Boilers and Pressure Vessels Code, Welding and Brazing Qualifications.
- C. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- D. ANSI/ASME B31.5 - Refrigeration Piping.
- E. ANSI/ASTM B32 - Solder Metal.
- F. ANSI/ASTM B88 - Seamless Copper Water Tube.
- G. ANSI/AWS A5.8 - Brazing Filler Metal.
- H. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store piping and specialties in shipping containers with labels in place.
- B. Protect piping and specialties from entry of foreign material by leaving caps and plugs in place until installation.

**PART 2 - PRODUCTS**

2.01 PIPING

- A. Design Pressure: 450 psig.
  - 1. Maximum Design Temperature: 250°F.
- B. Piping - 4" and under; Brazed Joint:
  - 1. Tubing: Type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation.
  - 2. Joints: Brazed with silver solder.
  - 3. Fittings: Wrought copper solder joint, ANSI B16.22.
  - 4. Special Requirements: All tubing shall be cleaned, dehydrated, pressurized with dry nitrogen, plugged and tagged by manufacturer "for refrigeration service". During brazing operations, continuously purge the interior of the pipe with nitrogen to prevent oxide formation.

2.02 MOISTURE AND LIQUID INDICATORS

- A. UL listed, with copper, brass, or copper-plated steel body, flared or solder ends, extended fittings in units up to at least 1-1/8" to allow brazing without removing the cartridge, sight glass, color coded paper moisture indicator that is replaceable without breaking piping connections for units up to 1-1/8" size, and plastic cap; maximum working pressure of 500 psi, and maximum temperature of 200°F.

2.03 VALVES

- A. BA-14: Refrigerant Ball Valve: 3/8" thru 3-1/8", 500 psi, -40°F to +300°F, full-port up to 2-1/8" size, blow-out proof, PTFE seals, brass ball with equalizing orifice, visible position indication, seal cap, extended copper connections, replaceable stem seals, compatible with all CFC, HCFC, and HFC refrigerants.

2.04 CHECK VALVES

- A. CK-10: 1/4" thru 3-5/8", 500 psi, globe or angle pattern, brazed, brass body, cleaned-dried-plugged and tagged at factory for refrigerant service.

2.05 PRESSURE RELIEF VALVES

- A. RV-5: Straight Thru or Angle Type: Brass body and disc, Teflon seat, factory sealed and stamped with ASME UV and National Board Certification NB; selected to ANSI/ASHRAE 15.

## 2.06 FILTER-DRIERS

- A. Replaceable Cartridge Angle Type: ANSI/AHRI 710, UL listed, brass or epoxy-coated steel shell, molded desiccant high-water capacity filter core(s); maximum working pressure of 500 psi; maximum temperature of 275°F; maximum pressure drop of 3 psi with R410a or 1.5 psi with R134a at system flow rate.

## 2.07 SUCTION FILTERS

- A. Replaceable Cartridge Angle Type: UL listed for 500 psi up to 2-18" size, and 400 psi for larger sizes, steel shell that passes 1000-hour salt spray test with copper fittings, replaceable pleated filter element(s); maximum pressure drops of 3 psi with R410a or 2 psi with R134a at system flow rate, capable of accepting molded desiccant core for cleanup after compressor burnout, access valve in the removable end plate. Install with side refrigerant inlet.

## 2.08 SOLENOID VALVES

- A. Valve: AHRI 760; pilot operated; copper or brass body and internal parts; synthetic seat; stainless steel stem and plunger assembly; extended solder ends to permit installation without disassembly; maximum working pressure of 500 psi; normally closed. Maximum pressure drop at system flow of 5 psi for R410a and 3 psi for R134a.
- B. Coil Assembly: UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, surge protector and color-coded lead wires, integral junction box, Class F temperature rated, ANSI/UL 429.

## 2.09 EXPANSION VALVES

- A. Angle or Straight Thru Type: ANSI/AHRI 750; materials suitable for system refrigerant, external equalizer, adjustable super heat setting, balanced port design, suitable for horizontal or vertical installation, with replaceable capillary tube and remote sensing bulb.
- B. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10°F super heat. Select to avoid being undersized at full load or excessively oversized at part load.

## 2.10 RECEIVERS

- A. All receivers shall have capacity to hold the entire refrigerant charge when 90% full at 90°F per ASHRAE 15-78.
- B. 6" and Smaller Internal Diameter: ANSI/AHRI 495, UL listed, steel or copper, brazed; 450 psi working pressure, with tappings for inlet, outlet, and relief valve or fusible plug.

## 2.11 SUCTION ACCUMULATORS

- A. All accumulators shall have capacity to hold 50% of the refrigerant charge when 90% full at 90°F per ASHRAE 15-78, pressure drop equivalent to under 0.5°F at peak capacity, a finish that survives a 500-hour salt spray test, vertical design with dip tube and screened oil inlet orifice, and a hot gas boil-out coil to evaporate liquid refrigerant.

- B. 6" and Smaller Internal Diameter: ANSI/AHRI 495, UL listed, steel or copper, brazed; 400 psi pressure rating, with tappings for inlet, outlet, and pressure relief valve or fusible plug.

#### 2.12 EXPANSION COMPENSATION

- A. Assembly consisting of two flexible connectors, two copper flexible connectors, two 90° elbows, and a 180° return pipe. Unit shall be in the form of a pipe loop.
- B. Connectors shall have corrugated copper hose bodies with copper braided casings.
- C. Connectors shall be rated for 150 psi working pressure at 70°F.
- D. Sizes 2" and smaller shall have copper sweat ends.
- E. Connectors shall be suitable for 1/2" permanent misalignment.
- F. Manufacturer:
  - 1. Metraflex Type MLS

### **PART 3 - EXECUTION**

#### 3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories.

#### 3.02 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.
- F. Group piping whenever practical at common elevations and locations. Slope piping 1% in direction of oil return.
- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.



- H. Provide clearance for installation of insulation and access to valves and fittings.
- I. Provide access doors for concealed valves and specialties.
- J. Where pipe support members are welded to structural building frame, brush clean, and apply zinc rich primer to welding.
- K. Insulate piping and equipment; per Section 230719 and Section 230716.
- L. Provide external equalizer piping on expansion valves, and locate expansion valve sensing bulb immediately downstream of evaporator on suction line. Connect distributor to expansion valve outlet.
- M. Install flexible connectors parallel to the shafts of compressors.
- N. Fully charge system with refrigerant after testing.

### 3.03 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be rejected and removed from the job immediately.
- B. All pipe, fittings, valves, equipment and accessories shall have factory applied identification sufficient to determine their conformance with specified requirements.
- C. Exercise care at all times to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any item that is not clean.
- D. During construction, until system is fully operational, keep all openings in piping and equipment closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.
- E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings.
- F. Cut all pipe to exact measurement and install without springing or forcing.

### 3.04 APPLICATION

- A. Provide solenoid valves in liquid lines of systems, in oil bleeder lines to stop flow of oil and refrigerant into the suction line when system shuts down, and in hot gas bypass lines, as applicable.
- B. Provide refrigerant charging valve connections.
- C. Provide replaceable cartridge filter-driers, with three-valve bypass assembly and suction filters without bypass assembly.

### 3.05 JOINING OF PIPE

- A. Brazed Joints:

1. Make up joints with brazing filler metal conforming to ANSI/AWS A5.8. Cut copper tubing ends perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt, and grease just prior to brazing. Apply flux evenly, but sparingly, to all surfaces to be joined. Brazing filler metal with a flux coating may also be used. Heat joints uniformly to proper brazing temperature so braze filler metal flows to all mated surfaces. Wipe excess braze filler metal, leaving a uniform fillet around cup of fitting.
2. Flux shall conform to ANSI/AWS A5.31.
3. Remove composition discs and all seals during brazing if not suitable for a minimum of 840°F or greater than the melting temperature of the brazing filler metal, whichever is greater.

### 3.06 FIELD QUALITY CONTROL

- A. Test piping system with nitrogen at 300 psig for at least 8 hours without loss of pressure.
- B. Comply with ASHRAE Standard 147 for refrigerant system integrity testing.
- C. After pressure testing, evacuate all refrigerant piping to at least 28" of mercury for 24 hours without loss of vacuum. Ensure moisture does not enter the piping prior to and during the tests.

**END OF SECTION**

## SECTION 23 3100 - DUCTWORK

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Galvanized Ductwork
- B. Aluminum Ductwork
- C. Ductwork Reinforcement
- D. Ductwork Sealants
- E. Rectangular Ductwork
- F. Flexible Duct
- G. Grease Exhaust Duct
- H. Dishwasher Exhaust Duct
- I. Ductwork Penetrations

#### 1.02 REFERENCES: Conform to all applicable requirements of the following publications:

- A. ADC Flexible Duct Performance and Installation Standards, 3rd Edition 1996.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ANSI/AWS A5.11M (1997) - Specification for Nickel and Nickel Alloy Welding Electrodes for Shielded Metal Arc Welding.
- D. ASHRAE - Handbook 2012 Systems and Equipment; Chapter 19 - Duct Construction.
- E. ASHRAE - Handbook 2013 Fundamentals; Chapter 21 - Duct Design.
- F. ASHRAE 170 (latest published edition) - Ventilation of Health Care Facilities.
- G. ASTM A90 - Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- H. ASTM A167- Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet, & Strip.
- I. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- J. ASTM A924 - Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

- K. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- L. ASTM E90-02 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
- M. ASTM E413-87 - Classification for Rating Sound Insulation.
- N. AWS A5.14M (1997) - Specification for Nickel and Nickel Alloy Bare Welding Electrodes and Rods.
- O. AWS D9.1M/D9.1 - Sheet Metal Welding Code.
- P. IECC - International Energy Conservation Code (latest published edition)
- Q. NADCA ACR 2002 - Assessment, Cleaning, and Restoration of HVAC Systems.
- R. NADCA Standard 05 1997 - Requirements for the Installation of Service Openings in HVAC Systems.
- S. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
- T. NFPA 90B - Installation of Warm Air Heating and Air- Conditioning Systems.
- U. NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Equipment.
- V. SMACNA - Air Duct Leakage Test Manual.
- W. SMACNA - HVAC Duct Construction Standards.
- X. SMACNA - Phenolic Duct Construction Standard 022.
- Y. SMACNA - Round Industrial Duct Construction Standards - 1999 Edition.
- Z. UL 181 - Factory-Made Air Ducts and Air Connectors.
- AA. UL 181A - Closure Systems for Use with Rigid Air Ducts and Air Connectors
- BB. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors.
- CC. UL 1978 - Standard for Grease Ducts.
- DD. UL 2221 - Standard for Tests of Fire Resistive Grease Duct Enclosure Assemblies.

### **1.03 SUBMITTALS**

- A. Submit shop drawings per Section 23 0500.

### **1.04 DEFINITIONS**

- A. Duct Sizes shown on drawings are inside clear dimensions. Maintain clear dimensions inside any lining.

- B. Transitions are generally not shown in single-line ductwork. Where sizes change at a divided flow fitting, the larger size shall continue through the fitting.
- C. Exterior Duct: Ductwork located outside the conditioned envelope including exposed ductwork above the roof, outside exterior walls, in attics above insulated ceilings, inside parking garages, and crawl spaces.
- D. Interior Duct: Ductwork located within the conditioned envelope including return air plenums and indirectly conditioned spaces.

## **1.05 COORDINATION DRAWINGS**

- A. Reference Coordination Drawings article in Section 23 0500 for required duct systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.
- B. Duct drawings shall be at 1/4" minimum scale complete with the following information:
  1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.
  2. Differentiate ducts that are lined or wrapped. Include insulation thickness, type of insulation, and acoustical lagging.
  3. Location and size of all duct access doors.
  4. Room names and numbers, ceiling types, and ceiling heights.
  5. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.
  6. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings. Architectural plans will need to be obtained from the Architect.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL REQUIREMENTS AND SUPPORTS**

- A. Rectangular Duct - Single Wall:
  1. General Requirements:
    - a. All ductwork gauges and reinforcements shall be as listed in SMACNA Duct Construction Standards Chapter 2. Where necessary to fit in confined spaces, furnish heaviest duct gauge and least space consuming reinforcement.
    - b. Transitions shall not exceed the angles in Figure 4-7.
  2. Exceptions and modifications to the 2005 HVAC Duct Construction Standards are:
    - a. All ducts shall be cross-broken or beaded.
    - b. Snap lock seams are not permitted.
    - c. Turning vanes shall be used in all 90° mitered elbows, unless clearly noted otherwise on the drawings. Vanes shall be as follows:

- 1) Type 1:
  - a) Description: Single wall type with 22-gauge (0.029") or heavier vanes, 3-1/4" blade spacing, and 4" to 4-1/2" radius. Vanes hemmed if recommended by runner manufacturer. Runners shall have extra-long locking tabs. C-value independently tested at below 0.26. EZ Rail II by Sheet Metal Connectors or equal.
  - b) Usage: Limited to 3,000 fpm and vane lengths 36" and under.
- 2) Type 2:
  - a) Description: Double wall type with 3-1/4" blade spacing, 4-1/2" radius, 24-gauge minimum, and SMACNA Type 1 runners. C-value below 0.27.
  - b) Usage: No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48" long.
- 3) Type 3 (acoustical - where acoustical lagging is located or as noted on drawings):
  - a) Description: Same as Type 2, except filled with fiberglass and with slotted or perforated inner curve. Minimum insertion loss of 9 dB at 250 Hz and 6 dB at 1 KHz.
  - b) Usage: No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48" long.
- 4) Turning vanes shall operate quietly. Repair or replace vanes that rattle or flutter.
- 5) Runners must be installed at a 45° angle. Elbows with different size inlet and outlet must be radius type.
- 6) Omitting every other vane is prohibited.
- d. Where smooth radius rectangular elbows are shown, they shall be constructed per SMACNA Figure 4-2. Type RE1 shall be constructed with a centerline duct radius R/W of 1.0. Where shown on drawings, Type RE3 elbows with 3 vanes shall be used with centerline duct radius R/W of 0.6 (SMACNA r/W=0.1). RE1 or RE3 elbows may be used where mitered elbows are shown if space permits. Mitered elbows (with or without turning vanes) may not be substituted for radius elbows. Do not make branch takeoffs within 4 duct diameters on the side of the duct downstream from the inside radius of radius elbows.
- e. Rectangular branch and tee connections in ducts over 1" pressure class shall be 45° entry type per Figs. 4-5 and 4-6. Rectangular straight taps are not acceptable above 1" pressure class.
- f. Bellmouth fittings shown on return duct inlets shall expand at a 60-degree total angle horizontally and vertically (space permitting) and have length of at least 25% of the smallest duct dimension.
- g. Round taps off rectangular unlined ducts shall be flanged conical or bellmouth type (equal to Buckley Bellmouth or Sheet Metal Connectors E-Z Tap), or 45° rectangular with transition to round (equal to Sheet Metal Connectors Inc. High Efficiency Takeoff). Straight taps are acceptable if pressure class is 1" or less, round duct is 12" diameter or less, and the tap is not located between fans and TAB devices.

- h. Duct offsets shall be constructed as shown on drawings. Additional offsets required in the field shall be formed of mitered elbows without turning vanes for offsets up to 30° maximum angle in accordance with SMACNA offset Type 2. Offsets of greater than 30° angle shall be formed of radius elbows with centerline radius R/W=1.0 or greater. SMACNA Type 1 offsets are not permitted.
- i. All lined duct shall utilize dovetail joints where round or conical taps occur. The dovetail joints shall extend past the liner before being folded over.
- j. Cushion heads are acceptable only downstream of TAB devices in ducts up to ± 2" pressure class, and must be less than 6" in length.
- k. Slide-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.

1) Apply sealant to all inside corners. Holes at corners are not acceptable.

2) Manufacturers:

- a) Ductmate Industries - 25/35/45
- b) Nexus
- c) Mez
- d) WDCI
- e) Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.

- l. Formed-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.

1) Apply sealant to all inside corners. Holes at corners are not acceptable.

2) Flanges shall be 24-gauge minimum (not 26 gauge).

3) Manufacturers:

- a) Lockformer TDC
- b) TDF
- c) United McGill
- d) Sheet Metal Connectors
- e) Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.

**B. Round and Flat Oval Spiral Seam Ductwork - Single Wall:**

- 1. Conform to applicable portions of Rectangular Duct Section. Round or flat oval ductwork may be substituted for rectangular ductwork where approved by the Architect/Engineer. The spiral seam ductwork shall meet the standards set forth in this specification. The ductwork shall meet or exceed the specified cross-sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation.
- 2. Flat oval duct in negative pressure applications shall have flat sides reinforced as required for rectangular ducts of the same gauge with dimensions equal to the flat span of the oval duct.

3. 90° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.
4. Duct and fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA requirements for the specified pressure class. Ribbed and lightweight duct are not permitted.
5. Ductwork shall be suitable for velocities up to 5,000 fpm.
6. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.
7. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
8. Ducts with minor axis less than 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.
9. Reinforce flat oval ducts with external angles. Internal tie rods are permitted only as indicated for rectangular ductwork.
10. Transverse Joint Connections:
  - a. Crimped joints are not permitted.
  - b. Ducts and fittings 36" in diameter and smaller shall have slip joint connections. Size fitting ends to slip inside mating duct sections with minimum 2-inch insertion length and a stop bead. Use inside slip couplings for duct-to-duct joints, and outside slip couplings for fitting-to-fitting joints.
  - c. Ducts and fittings larger than 36" shall have flanged connections.
  - d. Secure all joints with at least 3 sheet metal screws before sealing.
  - e. Manufacturers, Slide-on Flanges:
    - 1) Ductmate Industries - SpiralMate
    - 2) Accuflange
    - 3) Sheet Metal Connectors are acceptable.
  - f. Manufacturers, Self-Sealing Duct Systems:
    - 1) Lindab
    - 2) Ward "Keating Coupling"

C. Round Snap-Lock Seam Ductwork - Single Wall:

1. Factory sealed snap-lock pipe. Transverse and longitudinal seams shall contain factory-applied self-sealing EPDM and co-polymer gasket. Snap-lock shall conform to SMACNA RL-8. Duct and gasket material shall meet the flame/smoke spread rating of 25/50 per ASTM-E84.
2. G-60 galvanized coating meeting ASTM A653 and ASTM A90 G-90 galvanized steel aluminum meeting ASTM B209 Alloy 3003 Temper H14 304 stainless steel meeting ASTM A480 2B Finish.
3. Snap-lock seams are only permitted on systems between -1"w.c. and 2"w.c. pressure class.
4. 90° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.
5. Duct and fittings shall meet the required minimum gauges listed in Chapter 3 of the SMACNA requirements for the specified pressure class.
6. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.
7. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
8. Manufacturers:



- a. GreenSeam Industries.

D. Hangers and Supports General Requirements:

1. Hanger and support materials shall be as defined within Materials and Application Specific section below.
2. Strap Hangers: Strap hanger shall be a minimum of 1 inch, 18 gauge attached to the bottom of ducts.
3. Cable Hangers:
  - a. Aircraft cable and slip cable hangers are acceptable for ducts up to 18" diameter. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork.
  - b. Manufacturers; Supports:
    - 1) Gripple
    - 2) Ductmate
    - 3) Duro Dyne
    - 4) Architect/Engineer approved
4. Integral Corner Connector Hanger: Integral hanger and corner assembly for use with TDC/TDF style duct flanges. Die stamped offset hanger connects to the flanged corner assembly. For use with aircraft cable or 1/4" or 3/8" diameter threaded rods. Tested to hold up to 1,400 lbs.. Install per manufacturer's ratings and instructions.
  - a. Manufacturers; Supports:
    - 1) EZ Hanger

**2.02 MATERIAL AND APPLICATION SPECIFIC**

A. Galvanized Steel:

1. General Requirements:
  - a. Duct and reinforcement materials shall conform to ASTM A653 and A924.
  - b. Interior Ductwork and reinforcements: G60 galvanized (0.60 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise.
  - c. Exterior Ductwork: G90 galvanized (0.90 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise. G60 is not acceptable for exterior use.
  - d. Ductwork reinforcement shall be of galvanized steel.
2. Duct Hangers and Support Material:
  - a. Ductwork hangers and supports shall be of galvanized or painted steel.
  - b. All fasteners shall be galvanized or cadmium plated.

B. Aluminum Ductwork:

1. General Requirements:

- a. Material: ASTM B209; aluminum sheet, Alloy 3003-H14. Aluminum connectors and bar stock: Alloy 6061-T6. Aluminum or stainless steel fasteners are acceptable.
  - b. All duct gauges and reinforcement shall be as called for in Tables 2-50, 2-51, 2-52, and 3-14 of the SMACNA HVAC Duct Construction Standards.
  - c. Ductwork reinforcement shall be of aluminum.
2. Duct Hangers and Supports Material:
- a. Ductwork hangers and supports shall be of aluminum. Slip cable hangers are acceptable if constructed of aluminum.
  - b. All fasteners shall be aluminum.
- C. Duct Hangers and Support Material:
- 1. Ductwork hangers and supports shall be of galvanized or painted steel.
  - 2. All fasteners shall be galvanized or cadmium plated.
- D. Grease Exhaust Duct:
- 1. Field Fabricated
    - a. All ductwork shall be 16 gauge minimum, Type 304L stainless steel. Concealed ductwork may be 16 gauge black steel.
    - b. Concealed Ductwork:
      - 1) Range hood/grease exhaust ducts having an area of 4 sf or less shall be 16 gauge carbon steel.
      - 2) Range hood/Grease exhaust ducts having an area greater than 4 sf shall be 14 gauge carbon steel.
    - c. All joints and fittings shall be continuously welded and liquid-tight.
    - d. Exposed ductwork shall have a #3 finish. Concealed ductwork may have a mill finish.
    - e. Do not penetrate fire rated partitions, unless protected as required by applicable codes.
    - f. Provide pre-fabricated access doors and labels required by NFPA 96 on sides of duct at least 1.5" from bottom. Provide access at each change in direction and at maximum 20-foot intervals in horizontal ducts. Provide access at every floor for vertical ducts.
    - g. Install grease traps in kitchen grease and dishwasher ducts at base of all vertical risers and low points in the system.
    - h. Where grease ducts are 20" x 20" or larger, install access for personnel to enter duct. Duct supports must be sized to support the duct weight and an additional 800 lbs per NFPA 96.
    - i. Install ducts with proper clearance to combustible and limited-combustible materials.
    - j. Grease ducts installed with volume dampers shall conform to the damper specified in ductwork accessories.
    - k. Grease exhaust duct doors shall be grease and airtight, UL 1978 listed, meet NFPA 96 standards, and all mechanical codes. Grease duct access doors can be sandwich type or with a weld-on frame, with/without hinge.

- 1) Manufacturer, Duct Doors:
  - a) Ductmate Industries "Ultimate I" or "Ultimate II" Style door
  - b) Approved equal

- l. All grease duct access doors used must be accompanied by independent testing in conjunction with each manufacturer's respective wrap system for high temperature applications.
- m. Refer to Section 23 0713 for duct insulation material and insulated access door when required to provide proper enclosure of ductwork.

2. Prefabricated System (Round):

- a. Inner Liner: 0.035" Type 304 stainless steel.
- b. Outer Liner: 0.025" aluminized steel.
- c. Insulation: 4" annular space between inner and outer walls shall be filled with 4" of high temperature ceramic fiber insulation.
- d. Seal ductwork liquid-tight by mechanical joint consisting of integral flanges, with stainless steel flange band and sealed with type P080 sealant.
- e. Ductwork shall include hood and fan transitions, cleanout ports, fire suppression and washdown nozzles, expansion joints, and other ductwork provided by manufacturer to ensure completely rated system.
- f. Ductwork shall require zero clearance to combustibles. Seal and/or firestop ductwork through non-rated and up to two hour rated penetrations. Firestop with ductwork manufacturer approved materials.
- g. Provide all duct access doors and labels required by NFPA 96. Provide access at each change in direction and at maximum 12-foot intervals.
- h. Where grease ducts are 20" diameter or larger, install access for personnel to enter duct. Duct supports must be sized to support the duct weight and an additional 800 lbs per NFPA 96.
- i. Do not penetrate fire rated partitions, unless protected as required by applicable codes.
- j. Anchor duct with manufacturer approved materials of a minimum 5/8" diameter.
- k. Grease exhaust duct doors shall be grease and airtight, UL 1978 listed, meet NFPA 96 standards, and all mechanical codes. Grease duct access doors can be sandwich type or with a weld-on frame, with/without hinge.

- 1) Manufacturer, Duct Doors:
  - a) Ductmate Industries "Ultimate Round" style door
  - b) Approved equal

- l. All grease duct access doors used must be accompanied by independent testing in conjunction with each manufacturer's respective wrap system for high temperature applications.
- m. Ductwork shall be rated for continuous operation at 500°F and intermittently at 2000°F.
- n. System shall be listed as a 2-hour fire rated shaft enclosure per UL 2221.
- o. Manufacturers:

- 1) Metal-Fab No Chase
- 2) Schebler

### 3) Security Chimneys

#### E. Dishwasher Exhaust Duct:

1. Ductwork shall be 16 gauge minimum Type 304L stainless steel.
2. All joints and fittings shall be continuously welded and liquid-tight.
3. Ductwork exposed in kitchens shall have a #3 finish. Concealed ductwork may have a standard mill finish.
4. Do not penetrate fire rated partitions, unless protected as required by applicable codes.

#### 2.03 DUCTWORK REINFORCEMENT

##### A. All reinforcement shall be external to the duct except that tie rods may be used with the following limitations.

1. Ducts must be over 18" wide.
2. Duct dimensions must be increased 2" in one dimension (h or w) for each row of tie rods installed.
3. Tie rods must not exceed 1/2" diameter.
4. Manufacturer of tie rod system must certify pressure classifications of various arrangements, and this must be in the shop drawings.

#### 2.04 DUCTWORK SEALANTS

##### A. One-part joint sealers shall be water-based mastic systems that meet the following requirements: maximum 48-hour cure time, service temperature of -20°F to +175°F, resistant to mold, mildew and water, flame spread rating below 25 and smoke-developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Mastic used to seal flexible ductwork shall be marked UL 181B-M. Joint sealers for use on exterior weather exposed ductwork shall be rated for -30°F to +175°F and 2000-hour minimum UV resistance per ASTM G-53.

##### B. Two-part joint sealers shall consist of a minimum 3" wide mineral-gypsum compound impregnated fiber tape and a liquid sealant. Sealant system shall meet the following requirements: maximum 48-hour cure time, service temperature of 0°F to 200°F, resistant to mold, mildew, and water, flame spread rating below 25 and smoke developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Joint sealers for use on exterior weather exposed ductwork shall be rated for -30°F to +175°F and 2000-hour minimum UV resistance per ASTM G-53.

##### C. Pressure sensitive tape used for sealing ductwork shall be minimum 2.5-inch wide, listed and marked UL 181A-P, having minimum 60 oz/inch peel adhesion to steel, and service temperature range from -20°F to +250°F.

##### D. Where pressure sensitive tape is called for on drawings and specifications for sealing flexible ductwork, tape shall be minimum 2.5-inch wide, UL 181 B-FX listed, and marked tape having minimum 60 oz/inch peel adhesion to steel and service temperature range from -20°F to +250°F.

##### 1. Manufacturers, Pressure-Sensitive Tape:

- a. Venture Tape 1581A

- b. Compac #340
- c. Scotch Foil Tape 3326
- d. Polyken 339

## **2.05 FLEXIBLE DUCT**

- A. Flexible duct shall be listed and labeled as UL 181 Class 1 Air Duct Material, and shall comply with NFPA 90A and 90B, and meet GSA, FHA and other U.S. Government agency standards. Flexible duct shall bear the ADC Seal of Certification.
- B. Flame Spread/Smoke Developed: Not over 25/50.
- C. Stretch all flexible duct to prevent sags and reduce air friction. Shorten and reinstall all sagging or loose flexible duct. Avoid sharp elbows. Elbows shall maintain 1.5 diameter centerline turning radius.
- D. Install per the SMACNA Flexible Duct Manual. Secure inner layer with draw band. Wrap with pressure sensitive tape for protection prior to installing draw band. Pressure sensitive tape alone is not acceptable.
- E. Standard:
  - 1. Flexible duct shall have corrosion-resistant wire helix, bonded to an inner liner that prevents air from contacting the insulation, covered with minimum 1-1/2", 3/4 lb/cf density fiberglass insulation blanket, sheathed in a vapor barrier of metalized polyester film laminated to glass mesh. .

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Provide openings in ducts for thermometers and controllers.
- B. Locate ducts with space around equipment for normal operation and maintenance.
- C. Do not install ducts or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the electrical equipment. Unless intended to serve these rooms, do not install any ductwork or equipment in electrical rooms, transformer rooms, electrical closets, telephone rooms or elevator machine rooms.
- D. Provide temporary closures of metal or taped polyethylene on open ducts to prevent dust from entering ductwork.
- E. Supply ductwork shall be free of construction debris, and shall comply with Level "B" of the SMACNA Duct Cleanliness for New Construction Guidelines.
- F. Repair all duct insulation and liner tears.
- G. Install manual volume dampers in branch supply ducts so all outlets can be adjusted. Do not install dampers at air terminal device or in outlets, unless specifically shown.

- H. Install flexible duct in accordance with the ADC Flexible Duct Performance and Installation Standards.
- I. Flexible duct shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required, to include, but not limited to, all connections to air inlets, air outlets, and terminal air boxes.
- J. Install all exterior ductwork per SMACNA Fig. 6-3. Where drawings do not indicate otherwise, ductwork seams and joints shall be sealed watertight and pitched to shed water.
- K. Support all duct systems in accordance with the SMACNA HVAC Duct Construction Standards: Metal and Flexible and the SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, where applicable. Refer to Section 23 0550 for seismic requirements.
- L. Adhesives, sealants, tapes, vapor retarders, films, and other supplementary materials added to ducts, plenums, housing panels, silencers, etc. shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.
- M. All duct support shall extend directly to building structure. Do not support ductwork from pipe hangers unless coordinated with piping contractor prior to installation. Do not allow lighting or ceiling supports to be hung from ductwork or ductwork supports.
- N. Kitchen Grease and Dishwasher Ductwork:
  - 1. All kitchen grease and dishwasher ductwork shall be installed with a continuous slope and grease tight welds on all seams and joints.

### **3.02 DUCTWORK APPLICATION SCHEDULE**

- A. General:
  - 1. Seal Class is per SMACNA HVAC Air Duct Leakage Test Manual
  - 2. Insulation:
    - a. Refer to Section 23 0713 for insulation types.
    - b. Type A insulation (Flexible Fiberglass Wrap) R-values noted are based on installed values (25% compression).
  - 3. Note 1: Apply aluminum based adhesive sealant tape at non-flanged joints on ducts serving dedicated outside air supply (DOAS) and exhaust system in addition to Class A sealant.
  - 4. Note 2: Apply aluminum based adhesive sealant tape on TAB boxes (all seams and joints of the box and duct connections) serving dedicated outside air supply (DOAS) system.
- B. Constant Volume from Fan to Outlet:
  - 1. Shape:
    - a. Rectangular Duct - Single Wall
    - b. Round and Flat Oval Spiral Seam Ductwork - Single Wall
    - c. Round Snap-Lock Seam Ductwork - Single Wall
  - 2. Material: Galvanized Steel

3. Pressure Class: +2"
4. Seal Class: A
5. Insulation:
  - a. ASHRAE 90.1-2019: 1-1/2" thick Type A (R=4.5)
  - b. IECC-2021: 1-1/2" thick Type A (R=4.5)
6. Additional Requirements: None

C. Return Duct:

1. Shape:
  - a. Rectangular Duct - Single Wall
  - b. Round and Flat Oval Spiral Seam Ductwork - Single Wall
2. Material: Galvanized Steel
3. Pressure Class: -2"
4. Seal Class: A
5. Insulation:
  - a. ASHRAE 90.1-2019: None
  - b. IECC-2021: None
6. Additional Requirements: None

D. Exterior Return Duct:

1. Shape:
  - a. Rectangular Duct - Double Wall
  - b. Round and Flat Oval Spiral Seam Ductwork - Double Wall
2. Material: Galvanized Steel
3. Pressure Class: -2"
4. Seal Class: A
5. Insulation:
  - a. ASHRAE 90.1-2019: 2" thick Type B (R=6)
  - b. IECC-2021: 2" thick Type B (R=6)
6. Additional Requirements: None

E. General Exhaust Duct:

1. Shape:
  - a. Rectangular Duct - Single Wall
  - b. Round and Flat Oval Spiral Seam Ductwork - Single Wall
2. Material: Galvanized Steel
3. Pressure Class: -1"
4. Seal Class: A

5. Insulation: None
  6. Additional Requirements: None
- F. Relief/Exhaust Air Duct from Fan to Exhaust Outlet:
1. Shape:
    - a. Rectangular Duct - Single Wall
    - b. Round and Flat Oval Spiral Seam Ductwork - Single Wall
  2. Material: Galvanized Steel
  3. Pressure Class: +2"
  4. Seal Class: A
  5. Insulation:
    - a. ASHRAE 90.1-2019: 1-1/2" thick Type A (R=4.5)
    - b. IECC-2021: 1-1/2" thick Type A (R=4.5)
- G. Grease Exhaust Duct:
1. Shape: Refer to "Grease Exhaust Duct"
  2. Material: Field Fabricated
  3. Pressure Class: -2"
  4. Seal Class: A
  5. Insulation: Type F where fire rating is needed
- H. Dishwasher Exhaust Duct:
1. Shape: Refer to "Dishwasher Exhaust Duct"
  2. Material: Dishwasher Exhaust Duct
  3. Pressure Class: -1"
  4. Seal Class: A
  5. Insulation: None
- I. Outside Air Intake from Louver to Heating Coil:
1. Shape:
    - a. Rectangular Duct - Single Wall
    - b. Round and Flat Oval Spiral Seam Ductwork - Single Wall
  2. Material: Galvanized Steel
  3. Pressure Class: -2"
  4. Seal Class: A
  5. Insulation: 1 1/2" thick Type B (R=6.0)
- J. Mixed/Make-up Air Duct:
1. Shape:
    - a. Rectangular Duct - Single Wall
    - b. Round and Flat Oval Spiral Seam Ductwork - Single Wall



2. Material: Galvanized Steel
3. Pressure Class: -2"
4. Seal Class: A
5. Insulation:
  - a. ASHRAE 90.1-2019: 1-1/2" thick Type A (R=4.5)
  - b. IECC-2021: 1-1/2" thick Type A (R=4.5)

K. Relief Air Louver to Backdraft Damper:

1. Shape:
  - a. Rectangular Duct - Single Wall
  - b. Round and Flat Oval Spiral Seam Ductwork - Single Wall
2. Material: Galvanized Steel
3. Pressure Class: +2"
4. Seal Class: A
5. Insulation:
  - a. ASHRAE 90.1-2019: 1 1/2" thick Type B (R=6.0)
  - b. IECC-2021: 1 1/2" thick Type B (R=6.0)

L. Transfer Ducts:

1. Shape:
  - a. Rectangular Duct - Single Wall
  - b. Round and Flat Oval Spiral Seam Ductwork - Single Wall
2. Material: Galvanized Steel
3. Pressure Class: -1/2"
4. Seal Class: A
5. Insulation: 1" thick Type C (R=3.6)

M. Ductwork Accessories (Fabric Flex Connectors, Equipment Flanges, etc.):

1. Insulation:
  - a. ASHRAE 90.1-2019: 1-1/2" thick Type A (R=4.5)
  - b. IECC-2021: 1-1/2" thick Type A (R=4.5)

N. Linear Diffuser Supply Plenum:

1. Insulation:
  - a. ASHRAE 90.1-2019: 1/2" thick Type C (R=1.8)
  - b. IECC-2021: 1/2" thick Type C (R=1.8)

### **3.03 DUCTWORK SEALING**

- A. General Requirements:
1. Openings, such as rotating shafts, shall be sealed with bushings or similar.
  2. Pressure sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory and the tape is used in accordance with that certification.
  3. All connections shall be sealed including, but not limited to, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed.
  4. Mastic-based duct sealants shall be applied to joints and seams in minimum 3 inch wide by 20 mil thick bands using brush, putty knife, trowel, or spray, unless manufacturer's data sheet specifies other application methods or requirements.
- B. All ducts systems, regardless of pressure class, shall be Seal Class A as defined by Section 5-1 of SMACNA HVAC Air Duct Leakage Test Manual per the Energy Code, unless specifically noted otherwise. Seal Class A shall include sealing of all transverse joints, longitudinal seams, and duct wall penetrations with welds, gaskets, mastics, or fabric-embedded mastic system. Joints are inclusive of, but not limited to, girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal connections to ducts, access door and access panel frames and jambs, duct, plenum, and casing abutments to building structures.
- C. Double-wall ductwork: Install insulation end fittings at all transitions from double to single-wall construction.

### **3.04 TESTING**

- A. Test Procedure:
1. Testing shall be as listed in the latest edition of the SMACNA HVAC Duct Leakage Manual, with the following additional requirements:
    - a. The required leakage class for Seal Class A, rectangular ducts, shall be 4; round shall be 2.
    - b. Test pressure shall be the specified duct pressure class. Testing at reduced pressures and converting the results mathematically is not acceptable. This is required to test the structural integrity of the duct system.
    - c. If any leak causes discernible noise at a distance of 3 feet, that leak shall be eliminated, regardless of whether that section of duct passed the leakage test.
    - d. All joints shall be felt by hand, and all discernible leaks shall be sealed.
    - e. Totalling leakage from several tested sections and comparing them to the allowable leakage for the entire system is not acceptable. Each section must pass the test individually.
    - f. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing. Failure to notify the Architect/Engineer of pressure testing may require the contractor to repeat the duct pressure test after proper notification.
    - g. Upon completion of the pressure test, the contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.

- h. All access doors, taps to terminal air boxes, and other accessories and penetrations must be installed prior to testing. Including terminal air boxes in the test is not required.
- i. Positive pressure leakage testing is acceptable for negative pressure ductwork.

B. Grease Exhaust Duct:

1. A light test shall be performed by passing a lamp having a power rating of not less than 100 watts through the entire section of ductwork to be tested. The lamp shall be open to emit light equally in all four directions.
2. Testing of the entire exhaust duct system including the hood-to-duct connection shall be performed. Ductwork shall be permitted to be tested in sections provided every joint is tested.
3. Leakage testing shall occur prior to use or concealment of the duct system. Ducts shall be considered concealed where installed in shafts or covered by insulation or wrap that prevents ductwork from being visibly inspected on all sides. The test shall be performed in the presence of the code official.

**3.05 DUCTWORK PENETRATIONS**

- A. All duct penetrations of firewalls shall have fire or fire/smoke dampers where required by code.
- B. Dampers shall be compatible with fire rating of wall assembly. Verify actual rating of any wall being penetrated with Architect/Engineer.
- C. Seal all duct penetrations of walls that are not fire rated by caulking or packing with fiberglass. Install trim strip to cover vacant space and raw construction edges of all openings in finished rooms. Install escutcheon ring at all round duct openings in finished rooms. Trim strips and rings shall be same material and finish as exposed duct.

**END OF SECTION**

## SECTION 23 3300 - DUCTWORK ACCESSORIES

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Manual Volume Dampers.
- B. Grease Duct Volume Dampers.
- C. Fire/Smoke Dampers.
- D. Backdraft Dampers.
- E. Duct Access Doors.
- F. Remote Volume Control Devices.

#### 1.02 REFERENCES

- A. AMCA Guide for Commissioning and Periodic Performance Testing of Fire, Smoke and Other Life Safety Related Dampers.
- B. ASTM E477-06a - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
- C. ASTM E2336-04 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.
- D. NFPA 72 - National Fire Alarm and Signaling Code
- E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- F. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
- G. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.
- H. SMACNA - HVAC Duct Construction Standards (latest edition).
- I. UL 33 - Heat Responsive Links for Fire-Protection Service.
- J. UL 555 - Fire Dampers and Ceiling Dampers.
- K. UL 555C - Ceiling Dampers.
- L. UL 555S - Leakage Rated Dampers for Use in Smoke Control Systems.
- M. UL 2043 – Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

### **1.03 SUBMITTALS**

- A. Submit shop drawings under provisions of Section 23 0500.
- B. Submit manufacturer's installation instructions.

## **PART 2 - PRODUCTS**

### **2.01 MANUAL VOLUME DAMPERS**

- A. Fabricate in accordance with SMACNA Duct Construction Standards, and as indicated.
- B. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inches.
- C. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12" x 72". Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- D. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide molded synthetic or oil-impregnated nylon or sintered bronze bearings.
- E. Provide locking quadrant regulators on single and multi-blade dampers.
- F. On insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- G. If blades are in open position and extend into the main duct, mount damper so blades are parallel to airflow.

### **2.02 GREASE DUCT VOLUME DAMPERS**

- A. Venturi style damper comprised of an adjustment regulator control rod and casing.
- B. Materials: 16 gauge galvanized steel front panel and casing, 18 gauge stainless steel balancing panels.
- C. Damper shall provide access to duct to facilitate cleaning of the ductwork.
- D. Damper shall be UL 710 listed and fabricated in compliance with NFPA 96.

### **2.03 FIRE/SMOKE DAMPERS (FSD)**

- A. General:
  - 1. Furnish and install fire/smoke dampers in ducts, where shown on the drawings, at the point where they pass through a fire/smoke partition and in all other locations required by the local Fire Department, the National Fire Protection Association Pamphlet No. 90A, UL 2043, and all other applicable codes.
  - 2. Fire Resistance Rating: Assemblies shall be 1-1/2 hour rated under UL Standard 555 unless noted otherwise on drawings.
  - 3. Airflow Rating: Dynamic rated at 2,000 fpm and 4" WC.

4. Temperature Rating: Assemblies shall be UL 555S listed for use in smoke control system with a 250°F temperature rating.
5. Leakage Rating: Class II. Shall not leak over 20 cfm per square foot at 4" WC.
6. FSD dampers shall be furnished complete with factory-mounted actuators, and the damper/operator assemblies shall meet all requirements listed below.
7. Where dampers are located in aluminum or stainless steel duct, provide stainless steel dampers.
8. The complete assembly must be factory assembled, cycled and tested prior to shipment.
9. All operators shall be located with easy access for servicing.
10. Contractor to field verify actuator installation and clearance requirements prior to ordering. Actuator should not be taller than duct height. Rotate or turn over the actuator if this is the case.

B. Construction:

1. Frame: 5 inches x minimum 16 gauge roll formed, galvanized steel hat-shaped channel, reinforced at corners.
2. Sleeve: Dampers shall be installed in sleeves of sufficient thickness to comply with UL555 Standard for Safety Fire Dampers listing of the damper. Where UL555 permits sleeve thickness to be the same as that of the duct gauge, such thickness shall not be less than that specified in NFPA 90A for breakaway style sleeves. If a breakaway style duct/sleeve connection is not used, the sleeve shall be a minimum of 16 gauge for dampers up to 36" wide by 24" high and 14 gauge for dampers exceeding 36" wide by 24" high. Damper sleeve shall not extend more than 6" beyond the firewall or partition unless damper is equipped with an actuator or factory installed access door. Sleeve may extend up to 16" beyond the firewall or partition on sides equipped with the actuator or factory installed access door.
3. Blades: Opposed blade; airfoil-shaped, single piece, minimum 14 gauge double skin. Galvanized steel. Maximum 6" damper blades.
4. Seals: Blade seal shall be silicone fiberglass material to maintain smoke leakage rating to minimum of 450°F and galvanized steel for flame seal to 1,900°F. Seal to be mechanically attached to blade edge. Jam seal shall be stainless steel, flexible metal compression type.
5. Bearings: Self-lubricating stainless-steel sleeve, in extruded hole in frame.
6. Axle: Minimum 1/2" plated steel, hex shaped, mechanically attached to blade.

C. Temperature Release Device: FSD shall contain a single 165°F heat sensor capable of remote override of fire-induced closure to permit reopenable operation in a dynamic smoke management system. Controlled closing and locking of damper in 7 to 15 seconds to allow duct pressure to equalize. Wiring by Electrical Contractor.

D. Electric Actuator: Externally mounted, electric direct coupled. Actuator shall be 120V. Wiring by Electrical Contractor. Overload protections shall be either microprocessor or electronic-based motor controller providing burnout protection if stalled before full rotation is reached. The actuator shall electronically cut off at full open to eliminate noise generation. Actuator shall be mounted by means of a V-bolt dual nut clamp with a V-shaped toothed cradle. Aluminum clamps or setscrews are not acceptable. "Stall type" actuators are NOT acceptable. Actuator shall carry a manufacturer's 5 year warranty. Fail to closed position.

E. Access Door: Locate access door in ductwork for visual inspection and on the latch side to replace link easily. Each access door shall have a label with letters at least 1/2" high reading "FIRE/SMOKE DAMPER".

## **2.04 BACKDRAFT DAMPERS**

- A. Gravity backdraft dampers, size 18 inches x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturer's standard construction.
- B. Fabricate multi-blade, parallel action gravity balanced backdraft dampers of extruded aluminum, with blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90° stop, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.
- C. Models:
  - 1. Ruskin CBD4
  - 2. Arrow 655
  - 3. Safe-Air/Dowco BRL
  - 4. Greenheck EM.

## **2.05 DUCT ACCESS DOORS**

- A. Fabricate per Fig. 7-2 and 7-3 of the SMACNA HVAC Duct Construction Standards and as indicated.
- B. Review locations prior to fabrication. Install access doors at fire dampers, smoke dampers, motorized dampers, fan bearings, filters, automatic controls, humidifiers, louvers, duct coils and other equipment requiring service inside the duct.
- C. Construction shall be suitable for the pressure class of the duct. Fabricate rigid, airtight, and close-fitting doors of materials identical to adjacent ductwork with sealing gaskets butt or piano hinges, and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.
- D. Access doors with sheet metal screw fasteners are not acceptable.
- E. Minimum size for access doors shall be 24" x 16" or full duct size, whichever is less.
- F. Provide duct access door in all horizontal return ductwork at 20 foot intervals per NFPA 90A.
- G. Fire Damper, Fire/Smoke Damper Access Provide quantity of access doors such that two hands can fit inside ductwork to manually reset fire dampers. For ducts larger than 12x12 , provide one access door. For ducts 12" x 12" and smaller, provide one access door on bottom and one on side.

## **2.06 GREASE DUCT ACCESS DOORS**

- A. Provide pre-fabricated and pre-insulated duct access doors by the same manufacturer as the fire resistive duct wrap.

## **2.07 DUCTWORK ACCESSORY SEALANTS**

- A. Ductwork accessory sealants and adhesives shall conform to Section 23 3100.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

#### **A. General Installation Requirements:**

1. Install accessories in accordance with manufacturer's instructions.
2. Where duct access doors are located above inaccessible ceilings, provide ceiling access doors. Coordinate location with the Architect/Engineer.
3. Coordinate and install access doors provided by others.
4. Provide access doors for all equipment requiring maintenance or adjustment above an inaccessible ceiling. Minimum size shall be 24" x 24".
5. Grease duct access doors shall be installed per approvals from manufacturer's ICC-ES Evaluation Report.
6. Provide duct test holes where indicated and as required for testing and balancing purposes.

#### **B. Manual Volume Damper:**

1. Provide manual volume dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts where indicated on drawings and as required for air balancing. Use splitter dampers only where indicated.
2. Provide ceiling access doors for manual volume dampers. When manual volume dampers are located above an inaccessible ceiling and an access door cannot be installed, provide a remote-controlled volume control device for operation of the damper. Coordinate location with the Architect/Engineer.
3. Grease duct volume dampers shall be continuously welded to duct and/or hoods so that system is liquidtight.

#### **C. Fire Damper, Fire Smoke Damper, Smoke Damper:**

##### **1. Installation:**

- a. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves and duct connections.
- b. Provide ceiling access doors for smoke and/or fire dampers. Coordinate location with the Architect/Engineer.
- c. Provide manufacturer's maintenance instructions to Owner.
- d. At fire dampers, smoke dampers and combination fire smoke damper where duct is:
  - 1) Internally insulated, exterior duct wrap shall be installed from the wall out to 1 foot from the wall. All edges shall be taped.
  - 2) Externally insulated, the exterior duct wrap shall extend up to the wall.

##### **2. Commissioning/Testing and Acceptance:**

- a. Dampers shall be tested for function in their installed condition. Cycle all dampers to ensure proper operation and signal reporting as required by the manufacturer, building codes, and NFPA, with the minimum following requirements:



- 1) Visually inspect damper to ensure they are free from obstructions, have appropriate access, and are labeled.
- 2) Demonstrate resetting of fire dampers to Authorities Having Jurisdiction and Owner's representative as described below.
- 3) Dampers with Position Indication Wired to Indication Lights, Control Panels or BAS:
  - a) Confirm damper is full-open using position indicator signal.
  - b) Remove power to allow spring return to close damper.
  - c) Confirm damper is full-closed using position indicator signal.
  - d) Reapply power to reopen damper.
  - e) Confirm damper is full-open using position indicator signal.
- 4) Dampers without Position Indication:
  - a) Visually confirm damper is full-open using position indicator signal.
  - b) Remove power to allow spring return to close damper.
  - c) Visually confirm damper is full-closed.
  - d) Reapply power to reopen damper.
  - e) Visually confirm damper is full-open.

3. Report:

- a. Provide Commissioning/Testing and Acceptance Report documenting the following for all fire damper, fire smoke damper, smoke dampers.
- b. A copy of the report shall be filed with the fire code official and an identical copy shall be maintained in an approved location at the building.
- c. Report shall include the following:
  - 1) Damper ID#
  - 2) System identification (e.g. AHU-#)
  - 3) Type (FD, FSD, SD)
  - 4) Duct size
  - 5) UL assembly number
  - 6) Location of damper and access door
  - 7) Location of position indicator
  - 8) Fusible link temperature rating (if applicable)
  - 9) Manufacturer and model
  - 10) Commissioning testing and acceptance operation: Pass/Fail/Reset

**END OF SECTION**

## SECTION 23 3416 - CENTRIFUGAL FANS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Airfoil Centrifugal Fans.
- B. In-line Centrifugal Fans.
- C. Fabrication: Conform to AMCA 99.
- D. Fan Energy Index (FEI): Fans shall meet or exceed the minimum FEI scheduled at the specified airflow, pressure, and air density (duty point). In no case shall the FEI at the specified duty point fall below 1.0.

#### 1.02 REFERENCES

- A. AMCA 99 - Standards Handbook.
- B. AMCA 208 - Calculation of the Fan Energy Index (FEI).
- C. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
- D. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
- E. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
- F. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- G. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- H. SMACNA - HVAC Duct Construction Standards (latest edition).

#### 1.03 SUBMITTALS

- A. Submit shop drawings per Section 23 0500. Include data on all fans and accessories. Submit sound power levels for both fan inlet and outlet at rated capacity. Submit motor ratings and electrical characteristics, plus motor and electrical accessories. Submit multi-speed fan curves including minimum and maximum fan speed with specified operating points clearly plotted. Submit the Fan Energy Index (FEI) at the selected duty point.
- B. Submit operation and maintenance data. Include instructions for lubrication, motor and drive replacement, and spare parts list.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors, shafts, and bearings from weather and construction dust.

## **PART 2 - PRODUCTS**

### **2.01 AIRFOIL CENTRIFUGAL FANS**

- A. Fan Description: Double width, double inlet non-overloading centrifugal fan with airfoil blades.
- B. Construction:
  - 1. Wheel: Heavy gauge steel plate housing, continuously welded, reinforced with inverted angles.
    - a. Die formed, airfoil blades with moisture relief holes in the trailing edge. Formed from a single sheet of steel and welded at the trailing edge. Continuously weld blades to rim and bolt wheel to hub.
    - b. Spun steel shroud.
    - c. Cast iron hub with oversize flange, keyed to shaft. ANSI 1040 or 1045 cold rolled solid steel shaft, accurately turned, ground and polished. Shaft shall be a constant diameter. Shaft shall be straightened before and after cutting the keyways to maintain a maximum TIR of 0.002".
    - d. Dynamically balanced. First shaft critical speed at least 20% above maximum AMCA class speed.
    - e. Fans shall operate with variable speed drives. Balance fans to operate at all speeds from zero RPM to full design speed. Motors shall be "variable frequency drive rated" when controlled by VFDs.
  - 2. Housing: Deep contoured, spun or die formed inlet cones. 1-1/2" NPT drain with plug, continuously welded to lowest point of the scroll. Inspection door with waterproof gasketing. Flanged discharge collar drilled or punched at uniform intervals. Continuously weld flange to the fan housing.
  - 3. Drive: V belt drive selected for 1.5 times the brake horsepower (shaft power). Adjustable pitch sheaves for 20 HP and below. Fixed sheaves above 20 HP. Contractor shall provide replacement sheaves and belts for final air balancing.
  - 4. Support: Mount fan and motor on a common vibration isolation base.
- C. Protection:
  - 1. Screens: Inlet screens shall be minimum 8 gauge welded wire bolted to the fan for easy removal. Screens shall comply with OSHA opening size regulations. Attach screens directly to the fan.
  - 2. Belt Guards: Install removable belt guard with shaft holes for tachometer. Construct from expanded metal or heavy gauge wire mesh with minimum 70% free area.
- D. Bearings: Ball or roller bearings, grease packed or oil reservoir type. Bearing B-10 life of at least 200,000 hours at specified operating conditions. Extend lubrication lines beyond belt guards.
- E. Motor (as scheduled on drawings);
  - 1. Induction: Furnish externally mounted open drip-proof, ball bearing motor, with adjustable mounts for belt tightening. Motor shall be minimum 1/3 HP. Motor and wheel supported by vibration isolators. Refer to motor specification for motor requirements.

- F. Manufacturers:
  - 1. Aerovent
  - 2. Twin City
  - 3. Greenheck
  - 4. Chicago Blower
  - 5. Cook
  - 6. Peerless
  - 7. PennBarry Blower

## **2.02 IN-LINE CENTRIFUGAL FAN**

- A. Fan Description: In-Line Single inlet, single width. backward inclined wheel.
- B. Construction:
  - 1. Wheel: Backward inclined, non-overloading, all aluminum wheel and hub. Dynamically balanced.
  - 2. Housing: Galvanized steel construction with stainless steel or cadmium plated fasteners and galvanized steel belt guard.
  - 3. Drive: Belt drive with motor mounted on top of housing. Cast iron, adjustable pitch sheaves. V-belt drive sized for 1.5 of maximum horsepower. Screw adjustment belt tightener.
  - 4. Support: Steel or aluminum mounting frame with baked enamel finish. Steel mounting brackets suitable for any mounting position.
- C. Protection:
  - 1. Belt guards with tachometer knockouts on indoor fans. Removable weather covers on outdoor fans.
- D. Motor (as scheduled on the drawings):
  - 1. Induction: Furnish externally mounted open drip-proof, ball bearing motor. Refer to motor specification for motor requirements.
- E. Bearings: Regreasable bearings rated for 40,000 hour B-10 life at specified operating point. Extend lubrication lines outside of housing.
- F. Manufacturers:
  - 1. Jenco Fan
  - 2. Carnes
  - 3. Cook
  - 4. PennBarry
  - 5. Greenheck

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. General Installation Requirements:

1. Prime all fan parts after cleaning, but prior to assembly. Apply a second finish coat to all exterior surfaces and all accessible interior surfaces after assembly. Apply rust preventative coating to shafts.
2. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.
3. Install flexible connections between fan and ductwork. Install metal bands of connectors parallel with minimum 1" flex between ductwork and fan while running.
4. Provide safety screen where inlet or outlet is exposed. Screens shall meet OSHA regulations for size of openings.

B. Fume Exhaust Fan:

1. Each fume exhaust fan shall have a 3/8" diameter hole drilled in one of its base rails for electrical grounding. Scrape away paint near the hole for good grounding.

**END OF SECTION**

## SECTION 23 3700 - AIR INLETS AND OUTLETS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Grilles And Registers.
- B. Architectural Square Panel Diffusers.
- C. Linear Diffusers.
- D. Linear Diffuser Supply Plenum.
- E. Louvers.
- F. Roof Curbs.

#### 1.02 QUALITY ASSURANCE

- A. Test and rate performance of air inlets and outlets per ASHRAE 70.
- B. Test and rate performance of louvers per AMCA 500L-99.
- C. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

#### 1.03 REFERENCES

- A. AMCA 500-L-12 - Laboratory Methods of Testing Louvers for Rating.
- B. ANSI/ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Inlets and Outlets.
- C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- D. ASHRAE 170 (latest published edition) - Ventilation of Health Care Facilities.
- E. SMACNA - Duct Construction Standards.

#### 1.04 SUBMITTALS

- A. Submit product data under provisions of Section 23 0500.
- B. Submit schedule of inlets and outlets indicating type, size, location, application, and noise level.
- C. Review requirements of inlets and outlets as to size, finish, and type of mounting prior to submitting product data and schedules of inlets and outlets.

- D. Submit manufacturer's installation instructions.
- E. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

#### **1.05 REGULATORY REQUIREMENTS**

- A. Conform to ANSI/NFPA 90A.
- B. Conform to ASHRAE 90.1.

#### **1.06 EXTRA STOCK**

- A. Provide clean filters in all filter return grilles at time of installation.
- B. Provide one additional set of replacement filters for all filter return grilles. Deliver to Owner at job site.

### **PART 2 - PRODUCTS**

#### **2.01 AIR TERMINALS - GRILLES AND REGISTERS**

- A. Reference to a grille means an air supply, exhaust or transfer device without a damper.
- B. Reference to a register means an air supply, exhaust or transfer device with a damper.
- C. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule and suitable for the intended use.
- D. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents shall be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.
- E. The capacity and size of the unit shall be as shown on the drawings.
- F. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect. .
- G. Refer to the drawings for construction material, color and finish, margin style, deflection, and sizes of grilles and registers.
- H. Provide with 3/4" blade spacing. Blades shall have steel friction pivots to allow for blade adjustment, plastic pivots are not acceptable.
- I. Corners of steel grilles and registers shall be welded and ground smooth before painting. Aluminum grilles and registers shall have staked corners.
- J. Where specified to serve registers, provide opposed blade volume dampers operable from the face of the register.

- K. Where specified to have filters, provide with filter rack suitable for 2" thick MERV-8 pleated media filters. Grille border shall be fabricated from minimum 22 gauge steel or minimum 0.040-inch thick for aluminum grilles. Provide removable grille face with metal knurled knob or quarter turn fastener to allow for filter media replacement.
- L. Screw holes for surface fasteners shall be countersunk for a neat appearance. Provide concealed fasteners for installation in lay-in ceilings and as specified on the drawings.
- M. Manufacturers:
  - 1. Tuttle & Bailey
  - 2. Titus
  - 3. Price
  - 4. Nailor
  - 5. Carnes
  - 6. Metalaire
  - 7. Krueger
  - 8. Anemostat
  - 9. Raymon Donco

## **2.02 AIR TERMINALS - ARCHITECTURAL SQUARE PANEL DIFFUSERS**

- A. Reference to a diffuser means an air supply device, ceiling mounted, that shall diffuse air uniformly throughout the conditioned space.
- B. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule. Flat-oval inlets are not acceptable for connection to flexible ducts.
- C. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents should be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.
- D. The capacity and size of the unit shall be as shown on the drawings.
- E. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect. .
- F. Diffusers shall be architectural solid square panel and flush with ceiling.
- G. The exposed surface shall be smooth, flat and free of visible fasteners. The face panel shall be 22 gauge steel with a rolled edge or shall be 18 gauge with a smooth ground, uniform edge.
- H. The back pan shall be one piece 22 gauge stamped and shall include an integral inlet. (Welded inlets and corner joints are not acceptable).
- I. Diffusers with a 24x24 back pan shall have a minimum 18x18 face panel size. Diffusers with a 12x12 back pan shall have a minimum 9x9 face panel size.
- J. The face panel shall be mechanically fastened to the back panel with steel components. (Plastic fasteners are not acceptable.)



## **2.03 AIR TERMINALS - SQUARE MODULAR CORE DIFFUSERS**

- A. Reference to a diffuser means an air supply device, ceiling mounted, that shall diffuse air uniformly throughout the conditioned space.
- B. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule.
- C. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents should be brought to the attention of the Architect/Engineer, in writing, prior to bid date. Submission of bid indicates ceiling and air inlet and outlet types have been coordinated.
- D. The capacity and size of the unit shall be as shown on the drawings.
- E. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect. .
- F. Modular core diffusers shall consist of an outer frame assembly to facilitate mounting and shall include an integral square collar to allow connection to the square duct. Where shown on the drawings, the diffuser shall be supplied with a square to round adapter. Flat-oval inlets are not acceptable for connection to flexible ducts.
- G. The diffuser core shall consist of fixed louver directional modules that may be field adjusted from the diffuser face without any type of tools or mechanical device for one-way, two-way, two-way corner ,three-way or four-way horizontal discharge airflow.
- H. Each louvered module shall be removable to allow access to any damper or other component in or near the diffuser neck.
- I. The core's blade spacing shall be 1 inch on center.
- J. Manufacturers:
  - 1. Tuttle & Bailey
  - 2. Titus
  - 3. Price
  - 4. Nailor
  - 5. Carnes
  - 6. Metalaire
  - 7. Krueger
  - 8. Anemostat
  - 9. Raymon Donco

## **2.04 AIR TERMINALS - LINEAR DIFFUSER SUPPLY PLENUM**

- A. Linear diffusers shall be provided with field fabricated or prefabricated supply plenums. Plenum shall be a minimum of 2-1/2" wider than total slot width, minimum length of slot, and minimum height of 10". Plenums with end fed duct connections shall not exceed 8' in length. The cross sectional area of the plenum shall be designed for a maximum velocity of 500 fpm and the aspect ratio shall be limited to a width-to-height ratio of less than 1.5. Plenums with side outlets shall be designed for a maximum velocity of 600 fpm and inlet ducts to plenum shall be spaced 5' on center maximum. Inlet ducts to plenums shall have a maximum velocity of 900 fpm. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
- B. Plenum shall be constructed with 24 gauge galvanized steel and shall have side inlets unless shown otherwise on the drawings. Refer to Ductwork Application Schedule in Section 23 3100 for insulation requirements.
- C. End caps and required accessories shall be integral with the plenum or furnished and installed by the Mechanical Contractor.
- D. A manual volume damper shall be furnished and installed by the Mechanical Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings
- E. Prefabricated plenums shall be by the same manufacturer as the linear diffuser or Kees Inc.

## **2.05 LOUVERS - FIXED - ALUMINUM**

- A. Louvers shall be minimum 4" deep and constructed of extruded aluminum. Blade, jamb and sill thickness shall be minimum 0.081". Blades shall be spaced at a maximum of 5.1" apart.
- B. Louvers shall be of the drainable blade design with water collected on the leading edge of the blade and diverted to the jamb.
- C. Louvers shall be furnished with aluminum bird screen mounted on the inside surface.
- D. Size, cfm, finish and pressure drop for louvers shall be as scheduled on the drawings.
- E. AMCA Certified performance for 48" x 48" samples with intake airflow of 8,000 cfm shall not exhibit more than 0.19" pressure drop. Maximum water penetration shall be 0.01 ounces per square foot at the scheduled intake velocity based on 15 minute test duration when subjected to a water flow rate of 0.25 gal/min as described under the Water Penetration Test in AMCA 500-L-07.
- F. Contractor shall provide the General Contractor with the correct sizes and locations of all louvers required in masonry walls.
- G. Louvers shall be sealed around perimeter to avoid moisture penetration between the louver frame and wall.
- H. Louvers shall be suitable for duct connection.

I. Manufacturers:

1. Air Flow - "EA-403"
2. Arrow - "EA-415-D"
3. American Warming & Ventilating - "LE-21"
4. Construction Specialties - "A4097"
5. Dowco - "DBE-4"
6. Louvers & Dampers, Inc. - "IL-23"
7. Ruskin - "ELF375DX"
8. Vent Products - "2760"
9. Greenheck - ESD "403"
10. Pottorff - EFD
11. United Enertech FL-D-4

**2.06 LOUVERS - FIXED - GALVANIZED**

- A. Louvers shall be minimum 4" deep and constructed of galvanized steel with minimum 18 gauge frames and 16 gauge blades.
- B. Louvers shall be of the drainable blade design with water collected on the leading edge of the blade and diverted to the jamb.
- C. Louvers shall be furnished with 1/2" mesh 0.041 galvanized wire bird screen mounted on the inside surface.
- D. Size, cfm, finish and pressure drop for louvers shall be as scheduled on the drawings.
- E. AMCA Certified performance for 48" x 48" samples with intake airflow of 8,000 cfm shall not exhibit more than 0.19" pressure drop. Maximum water penetration shall be 0.01 ounces per square foot at the scheduled intake velocity based on 15 minute test duration when subjected to a water flow rate of 0.25 gal/min as described under the Water Penetration Test in AMCA 500-L-07.
- F. Contractor shall provide the General Contractor with the correct sizes and locations of all louvers required in masonry walls.
- G. Louvers shall be sealed around perimeter to avoid moisture penetration between the louver frame and wall.
- H. Louvers shall be suitable for duct connection.
- I. Manufacturers:

1. Air Flow
2. Arrow
3. American Warming & Ventilating
4. Carnes
5. Dowco
6. Louver and Dampers, Inc.
7. Ruskin
8. Vent Products
9. United Enertech SFL-D-4

## **2.07 ROOF CURBS**

- A. Furnish and install, where shown on the drawings, prefabricated roof curbs for all rooftop hood openings.
- B. Roof Mounting Curb: Curb shall be sized to match curb cap of the hood. Curb height as shown on drawings, minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood nailer.
- C. Curbs shall be unitized construction, 18 gauge galvanized steel, with continuous arc welded corner seams, insulated with 1-1/2" thick, 3 lb. density rigid fiberglass board and damper support angle.
- D. Curb without cant - suitable for use with membrane type roof.
- E. Curb with built-in cant with step for roof insulation.
- F. Manufacturers:
  - 1. Same manufacturer as the equipment it serves or Pate, RPS, or Thy.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. General Installation Requirements:
  - 1. Install items in accordance with manufacturers' instructions.
  - 2. Install seismic restraints according to SMACNA's "Kitchen Equipment Fabrication Guidelines, Appendix 1, Guidelines for Seismic Restraints for Kitchen Equipment".
  - 3. Check location of inlets and outlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.
  - 4. Install diffusers to ductwork with air tight connections.
  - 5. Flexible ducts shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required.
  - 6. Supply air diffusers in operating rooms (Class B and C surgery) shall be opened and cleaned before the space is used.
  - 7. Supply grille and register blades shall be aimed in the field to provide adequate air distribution in the space. All return grilles and registers blades shall be oriented to minimize sight distance beyond installed device.
- B. Volume Damper:
  - 1. Provide manual volume dampers on duct take-off to diffusers when there are multiple connections to a common duct. Locate volume dampers as far as possible from the air inlet or outlet.
- C. Maintaining Duct Cleanliness:
  - 1. When grilles, registers, and diffusers are installed, Contractor shall prevent construction dust, dirt, and debris from entering ductwork as required by Section 23 0500.

**END OF SECTION**

## SECTION 236213 - AIR COOLED CONDENSING UNITS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Condensing Unit Package.
- B. Charge of Refrigerant and Oil.
- C. Controls and Control Connections.
- D. Refrigerant Circuit.
- E. Motor Starters.
- F. Electrical Power Connections.

#### 1.02 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/UL - Safety for Heating and Cooling Equipment.
- C. AHRI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
- D. ASHRAE 23 - Methods of Testing for Rating Positive Displacement Condensing Units.

#### 1.03 SUBMITTALS

- A. Submit shop drawings per Section 230500 indicating components, assembly, dimensions, weights and loadings, required clearances, location and size of field connections, rated capacities, and electrical nameplate data. Include schematic layouts showing condensing units, cooling coils, refrigerant piping, and accessories required for complete system. Piping diagrams shall apply specifically to this job. Include description of capacity control logic and interface with building control system.
- B. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- C. Submit operation and maintenance data including start-up instructions, maintenance instructions, parts lists, controls, and accessories.
- D. Submit certification that condensing units, accessories, and components will withstand seismic forces defined in Section 230550. Include the following:
  - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.

- a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Manufacturer shall provide special seismic certification per HCAI CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.
- 1.04 DELIVERY, STORAGE, AND HANDLING
- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
  - B. Protect units on site from physical damage. Protect coils.
- 1.05 WARRANTY
- A. Provide a one-year parts and labor warranty. Compressors shall have an additional four year warranty covering all material and labor costs for compressor repair or replacement at the Owner's option.

## **PART 2 - PRODUCTS**

### 2.01 MANUFACTURED UNITS

- A. Units: Self-contained, packaged, factory assembled and wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, and screens.
- B. Construction and Ratings: In accordance with AHRI 210/240 and ANSI/UL 207 and 303. Testing shall be in accordance with ASHRAE 14.
- C. Performance Ratings: EER and COP meeting ANSI/ASHRAE 90.1.

### 2.02 CASING

- A. House components in welded steel frame with galvanized steel panels with painted finish meeting ASTM B117 salt spray test standard.
- B. Mount starters, disconnects, and controls in weatherproof panel with full opening access doors.
- C. Provide gasketed removable access doors or panels with quick fasteners.

### 2.03 CONDENSER COILS

- A. Aluminum fins mechanically bonded to seamless copper tubing. Provide 12°F of refrigerant subcooling at design conditions.

- B. Coil Guard: Painted expanded metal or PVC coated steel wire.
- C. Provide hail guards on all condenser coils.

#### 2.04 CONDENSER FANS AND MOTORS

- A. Vertical discharge direct drive propeller type condenser fans with fan guards.
- B. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or 3 phase, with permanent lubricated ball bearings and built in thermal overload protection.
- C. Dynamically and statically balanced fans.
- D. Separate motors for each fan.

#### 2.05 COMPRESSORS

- A. Construction: Semi-hermetic or hermetic scroll type with suction and discharge valves.
- B. Mounting: Dynamically balance rotating parts and mount on vibration isolators.
- C. Lubrication System: Oil pump with oil charging valve, oil level sight glass, oil filter, and magnetic plug or strainer.
- D. Capacity Reduction Equipment: Multiple compressors, and/or multi-speed or variable-speed compressors.
- E. Motor: Suction gas cooled with electronic sensor and winding over temperature protection.
- F. Crankcase Heater: Evaporates refrigerant in crankcase during shutdown.
- G. Suitable for operating on voltages plus or minus 15% of nameplate ratings.

#### 2.06 REFRIGERANT CIRCUIT

- A. Refrigerant may be new or reclaimed, and shall meet ARI-700-2004 Standard for Refrigerant Purity.
- B. Provide each unit with the number of refrigerant circuits needed to provide the scheduled unloading and properly transport oil.
- C. Provide the following for each refrigerant circuit:
  - 1. Replaceable core type filter dryer.
  - 2. Liquid line sight glass and moisture indicator.
  - 3. Thermal expansion valve.
  - 4. Insulated suction line.
  - 5. Suction and liquid line service valves.
  - 6. Schraeder valve.
  - 7. Condenser pressure relief valve.
  - 8. Suction filter.
  - 9. Liquid line solenoid valve.



- D. For heat pump units, provide reversing valve, suction line accumulator, discharge muffler, flow control check valve, and solid-state defrost control using thermistors.
- E. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.

## 2.07 CONTROLS

- A. On unit, mount NEMA 4 steel control panel containing power and control wiring, factory wired with single point power connection.
- B. For each compressor, provide across-the-line starter, factory wired non-fused disconnects, non-recycling compressor overload, starter relay, and control power transformer. For each condenser fan, provide across-the-line starter with starter relay.
- C. Provide the following safety controls arranged so operating any one will stop unit:
  - 1. Manual reset high discharge pressure switch for each compressor.
  - 2. Automatic reset low suction pressure switch for each compressor.
  - 3. Manual reset oil pressure switch.
- D. Provide the following operating controls:
  - 1. Timer(s) that prevents compressor short cycling.
  - 2. Low ambient temperature (as scheduled) thermostat to lock out compressor.
  - 3. If discharge or return air control is provided with the unit, provide adjustable time delay between stages of operation. All units shall be compatible with direct control of staging by DDC systems. Suction pressure control of staging is not acceptable.
  - 4. Pump down control that activates when the lead compressor of each circuit stops.
  - 5. Hot gas bypass sized for minimum compressor loading, or "Frostat" control. If hot gas is used, the pipe with modulating flow (hot gas or suction) must pitch continuously downward in the direction of flow.
  - 6. Thermostat to cycle fan motors in response to head pressure.
  - 7. Head pressure controlled damper or variable speed fan control on first stage condenser fan. Rated for starting at 0°F.

## 2.08 MANUFACTURERS

- A. Trane
- B. York
- C. Daikin
- D. Carrier
- E. Units shall be of the same manufacturer as the evaporator coil.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Comb all condenser coils to repair bent fins.
- C. Install on vibration isolators as scheduled on the drawings or in Section 230548.
- D. Connect to refrigeration piping and evaporators.

3.02 MANUFACTURER'S FIELD SERVICES

- A. Provide initial start-up by factory authorized service representatives. Adjust units to provide proper superheat.
- B. Supply initial charge of refrigerant and oil for each refrigerant circuit. Replace losses of refrigerant and oil during the warranty period.

**END OF SECTION**

## **SECTION 23 7416.12 - PACKAGED ROOFTOP AIR CONDITIONING UNITS 25 TON AND BELOW**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Packaged Rooftop Unit.
- B. Unit Controls.
- C. Roof Mounting Frame and Base.
- D. Economizers.
- E. Power Exhaust.

#### **1.02 QUALITY ASSURANCE**

- A. All insulation inside the unit and in the air stream must comply with the requirement of NFPA 90A (maximum flame spread of 25 and maximum smoke developed of 50).
- B. All units must be UL or ETL listed and must contain UL labeled components.
- C. Fans shall be tested and rated in cabinet in accordance with AMCA Standard 210. All fan assemblies shall be dynamically balanced in cabinet at final assembly.
- D. Conform to ASHRAE 90.1.
- E. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

#### **1.03 REFERENCES**

- A. AHRI 210 - Unitary Air Conditioning Equipment.
- B. AHRI 240 - Air Source Unitary Heat Pump Equipment.
- C. AHRI 270 - Sound Rating of Outdoor Unitary Equipment.
- D. ASHRAE 37 - Methods of Testing for Rating Unitary Air Conditioning and Heat Pump Equipment.
- E. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- F. NFPA 70 - National Electrical Code.
- G. NFPA 90A - Installation of Air Conditioning and Ventilating System.

- H. UL - Underwriters' Laboratory.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from physical damage by storing off site until roof mounting frames are in place, ready for immediate installation of units.

**1.05 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, installation instructions, maintenance and repair data, and parts listing.

**1.06 WARRANTY**

- A. Provide five (5) year manufacturer's warranty for compressors.
- B. Provide five (5) standard year manufacturer's warranty for heat exchanger.
- C. Provide three (3) standard year manufacturer's warranty for controls and electrical components (thermostats, VFD, etc.).

**1.07 MAINTENANCE SERVICE**

- A. Contractor shall furnish complete service and maintenance of packaged roof top units for one year from Date of Substantial Completion.
- B. Provide maintenance service with a two-month interval as maximum time period between calls. Provide 24-hour emergency service on breakdowns and malfunctions.
- C. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of four (quarterly) filter replacements, minimum of one fan belt replacement, and controls checkout, seasonal adjustments, and recalibrations.
- D. Submit copy of service call work order or report and include description of work performed to Owner and Architect/Engineer.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Basis of Design: The scheduled manufacturer is the Basis of Design. The Contractor is responsible for all costs, schedule impacts, and construction coordination, including design costs and regulatory agency approvals, related to using a specified alternate product other than the Basis of Design. Refer to Section 23 0500 for additional information.
- B. Trane
- C. York

- D. Daikin
- E. Carrier
- F. Bryant
- G. Lennox
- H. Ruud
- I. Valent
- J. Aaon

## **2.02 MANUFACTURED UNITS**

- A. Provide roof-mounted units having electric heating elements, and electric refrigeration.
- B. Unit shall be self-contained, packaged, factory assembled, pre-wired and tested, consisting of cabinet and frame, supply fan, exhaust fan, electric heating elements, controls, air filters, refrigerant cooling coil and compressor, condenser coil, condenser fan, and a full refrigerant charge.
- C. Unit shall be furnished with non-fused disconnect switch, short fuse protection of all internal electrical components, and all necessary motor starters, contactors, and over-current protection.

## **2.03 FABRICATION**

- A. Air Filters: One inch thick glass fiber disposable media in metal frames.

## **2.04 ROOF MOUNTING FRAME AND BASE**

- A. Roof Mounting Curb: Minimum 12 inches high, minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood nailer.

## **2.05 FANS/MOTORS**

- A. Fans:
  - 1. Supply Fans: centrifugal; SWSI plenum or vane axial fan.
  - 2. Exhaust Fans: Propeller or SWSI plenum fan.
  - 3. All fans shall be aluminum or composite construction with fan shaft: turned, ground and polished steel; keyed to wheel hub.
  - 4. Fan and motor assemblies shall be resiliently mounted.
  - 5. Direct drive motor.
  - 6. All fan bearings must be capable of being lubricated by easily accessible grease fittings.
  - 7. All fans must be statically and dynamically balanced.

## **2.06 ELECTRIC HEATING COIL**

- A. Finned tube heating elements easily accessible with automatic reset thermal cut-out, built-in magnetic contactors, galvanized steel frame, control circuit transformer and fuse, manual reset thermal cut-out, airflow proving device, fused disconnect,.
- B. Controls shall start supply fan before electric elements are energized and continue operating until air temperature reaches minimum setting, with switch for continuous fan operation.
- C. Heating shall have 1-2 stages of modulating SCR control.

## **2.07 HOT GAS REHEAT COIL**

- A. Provide copper tube with aluminum fin coil assembly.
- B. Valves to reroute hot refrigerant gas from the discharge line of the compressor through the reheat coil.

## **2.08 COMPRESSOR**

- A. Provide hermetic or semi-hermetic compressors (quantity as scheduled on drawings), 3600 rev/min maximum, resiliently mounted with positive lubrication, crankcase heater for operation down to 0°F, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.
- B. Five minute timed off circuit shall delay compressor start.
- C. Provide capacity control by staging multiple compressors.
- D. For heat pump units, provide reversing valve, suction line accumulator, flow control check valve, and solid-state defrost control utilizing thermistors.
- E. The use of hydrochlorofluorocarbon (HCFC) or chlorofluorocarbon (CFC) based refrigerants is prohibited.

## **2.09 CONDENSER**

- A. Condenser shall provide design capacity between the minimum and maximum ambient conditions scheduled on the drawings.
- B. Condenser Coil:
  - 1. Round Copper Tube and Aluminum Fins: Construct condenser coils of aluminum fins mechanically bonded to seamless copper tubing. Air test under water to 450 psig.
- C. Condenser Fans: Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Fan blade shall be aluminum or composite material.

- D. Condenser Motors: Fan motors shall be an ECM type motor for proportional control. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.
- E. Entire fan assembly shall be statically and dynamically balanced.
- F. Provide outdoor thermostat to cycle condenser fans.
- G. Provide hail guards on all condenser coils.
- H. Liquid and discharge isolation valves with staged and digital scrolls.

## **2.10 MIXING SECTION**

- A. Dampers: Provide outside, return, and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper shall fail to closed position. Relief dampers may be gravity balanced.
- B. Gaskets: Provide tight fitting dampers with edge gaskets. Gaskets must be mechanically fastened (use of adhesive alone shall not be acceptable). Damper blades shall be gasketed with side seals to provide an air leakage rate of Class 1A at 1" w.c. pressure differential for a 24"x 24" damper.
- C. Damper Actuator: 24 volt with gear train sealed in oil, with spring return on units 7.5 tons cooling capacity and larger.

## **2.11 ECONOMIZERS**

- A. Factory installed by approved rooftop unit manufacturer with fully modulating motorized outside air and return air dampers.
- B. To be controlled by differential enthalpy with fixed dry-bulb controller with minimum position setting.
- C. Shall be equipped with 100% capable relief barometric damper relieving up to 100% return air and sealed to meet ASHRAE 90.1 requirements.
- D. Shall be capable of introducing up to 100% outside air.
- E. Shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy.
- F. Dampers shall be capable of completely closing when unit is in unoccupied mode.
- G. Outside air damper normally closed and return air damper normally open.
- H. Provide factory installed and tested, outdoor air monitor that controls outdoor air  $\pm$  15% accuracy down to 40 cfm per ton.

## **2.12 POWER EXHAUST**

- A. Factory installed by economizer supplier or compatible equivalent.
- B. Controlled by economizer controls.
- C. Power exhaust shall be factory wired to electrical section complete with conduit, feeders, disconnect, and overcurrent protection. Power exhaust shall be energized based on building pressure or when dampers open past the adjustable setpoint of the economizer control.
- D. Must comply with Energy Code Fan Power Limitation formula.

## **2.13 ELECTRICAL**

- A. Provide with single point power connection to service all controls, dampers, outlet, and fans, complete with non-fused disconnect switch, short circuit protection of all internal electrical components, and all necessary motor starters, contactors, and over-current protection, transformer, and convenience outlet.
- B. All units must be so constructed that when the electrical section access panel is opened, all electrical power to the unit (with the exception of the 120 volt duplex convenience outlet) is disconnected by means of a single disconnect.
- C. All wiring must be labeled, numbered, and terminate in "spade clips". All terminal strips must be keyed to the wiring numbers. Each control device must be permanently labeled to indicate its function.
- D. Wiring diagrams for all circuits must be permanently affixed to the inside of the electrical section access panel. The markings of terminal strips and wiring must agree with the numbering on the wiring diagrams.
- E. All units shall include a transformer for controls and convenience outlet.
- F. Only one power cable connection to the unit shall be necessary.
- G. Motor shall include phase failure protection and prevent the motor from operation in the event of phase loss.

## **2.14 OPERATING CONTROLS - SINGLE ZONE UNITS**

- A. When ECM are applied:
  - 1. Single Zone VAV: The unit controller shall proportionally control the ECM motors on the supply fan based on space temperature. The unit controller shall increase/decrease the speed of the supply fan in order to maintain the space temperature within its setpoint and deadband. The unit controller shall provide discharge air temperature control with the compressor modulation.
- B. Room thermostat shall incorporate:
  - 1. Automatic switching from heating to cooling.
  - 2. Preferential rate control to minimize overshoot and deviation from set point.



3. Set-up for four separate temperatures per day.
4. Instant override of setpoint for continuous or timed period from one hour to 31 days.
5. Short cycle protection.
6. Programming based on weekdays, Saturday and Sunday.
7. Switch selection features including imperial or metric display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.

C. Room thermostat display shall include:

1. Time of day.
2. Actual room temperature.
3. Programmed temperature.
4. Programmed time.
5. Duration of timed override.
6. Day of week.
7. System model indication: heating, cooling, auto, off, fan auto, fan on.
8. Stage (heating or cooling) operation.

D. Provide low limit sequence to close outside air dampers and stop supply fan.

E. Mixed Air Controls: Maintain selected supply air temperature and revert dampers to minimum outside air position on a call for heating.

F. Dehumidification Controls: Maintain the relative humidity setpoint with the hot refrigerant gas reheat coil.

## **2.15 DDC TEMPERATURE CONTROLS**

A. Install standalone control module providing communication between unit controls and packaged DDC temperature control system.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings and illustrated by the manufacturer.
- B. Verify that proper power supply is available.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Mount units on factory built roof mounting curb and provide watertight enclosure to protect ductwork and utility services. Install unit level.
- C. All field wiring shall be in accordance with the National Electrical Code.
- D. P-traps must be provided for all drain pans.

- E. Comb all coils to repair bent fins.
- F. Contractor shall coordinate unit access stair and walkway placement to ensure compliance with OSHA requirements.

**END OF SECTION**

## **SECTION 23 8113 - PACKAGED TERMINAL AIR CONDITIONING UNITS**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Packaged Terminal Air Conditioning Units.
- B. Controls.

#### **1.02 REFERENCES**

- A. ANSI/ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. AHRI 210 - Unitary Air Conditioning Equipment.
- D. AHRI 270 - Sound Rating of Outdoor Unitary Equipment.
- E. MIL-H-22547B - Heat Pump, Heating and Cooling (Unitary).

#### **1.03 SUBMITTALS**

- A. Submit shop drawings and product data under provisions of Section 23 0500.
- B. Indicate water, drain, and electrical rough-in connections on shop drawings or product data.
- C. Submit manufacturer's installation instructions.
- D. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finished cabinets from physical damage by leaving factory packing cases in place before installation and providing temporary covers after installation.

#### **1.05 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION**

- A. Installation of wall sleeves in finished wall assembly by General Contractor.
- B. Section 23 0900 - Controls: Installation of thermostats and other control components.

#### **1.06 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

## **1.07 WARRANTY**

- A. Provide five (5) year manufacturer's warranty on all compressors. Warranty shall be for parts and labor.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURED UNITS**

- A. Provide packaged, self-contained, through-the-wall air cooled terminal air conditioning units, with wall sleeve, room cabinet, electric refrigeration system, electric heating, outside air louvers, remote temperature controls.
- B. Conform to ASHRAE 90.1.

### **2.02 CHASSIS**

- A. Install a drain pan under each cooling coil meeting requirements as outlined in ASHRAE 62.1. The drain pans shall extend the entire width of each coil, including piping and header if in the air stream. The length shall be as necessary to limit water droplet carryover beyond the drain pan to 0.0044oz per ft<sup>2</sup> of face area per hour under peak sensible and peak dew point design conditions, considering both latent load and coil face velocity. Pitch drain pans in two directions towards the outlet, with a slope of at least 1/8" per foot.
- B. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.

### **2.03 CONTROLS**

- A. Control Module: Remote mounted adjustable thermostat with heat anticipator, off-heat-auto-cool switch, high-low fan switch.
- B. Electric resistance heater shall be locked out when heating load can be met by heat pump alone, with the exception of outdoor defrost cycles.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with manufacturers' instructions.
- B. Coordinate installation of units with architectural and electrical work.
- C. Supply units fully charged with refrigerant and filled with oil.
- D. Scheduled performance is based on AHRI 210 or AHRI 240 test conditions. Scheduled sound rating is based on AHRI 270.

**END OF SECTION**

## SECTION 23 8126 - SPLIT SYSTEM AIR CONDITIONING UNITS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Split system air conditioning wall, and/or ceiling-concealed units.

#### 1.02 REFERENCES

- A. ARI 210 - Unitary Air Conditioning Equipment
- B. ARI 240 - Air Source Unitary Heat Pump Equipment
- C. ANSI NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- D. ANSI/ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
- E. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- F. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- G. ASHRAE 52 - Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- H. ASTM B1003 - Standard Specification for Seamless Copper Tube for Linesets.
- I. FS TT-C-490 - Cleaning Method and Pretreatment of Ferrous Surfaces for Organic Coatings.
- J. UL - Underwriters' Laboratories.

#### 1.03 SUBMITTALS

- A. Submit shop drawings under provisions of Section 23 0500.
- B. Indicate drain, electrical, and refrigeration rough-in connections on shop drawings or product data.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.
- B. Comply with manufacturer's installation instruction for rigging, unloading, and transporting units.
- C. Protect units from weather and construction traffic by storing in dry, roofed location until units are ready for immediate installation.

### **1.05 REGULATORY REQUIREMENTS**

- A. Conform to ANSI/NFPA 90A for the installation of computer room air conditioning units.
- B. Conform to ASHRAE 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

### **1.06 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

### **1.07 WARRANTY**

- A. Provide five (5) year manufacturer's warranty on all compressors.

## **PART 2 - PRODUCTS**

### **2.01 SPLIT SYSTEM WALL AND CEILING-MOUNTED UNITS**

#### A. Manufacturers:

1. Carrier/Toshiba
2. LG
3. Panasonic/Sanyo
4. Samsung
5. Daikin Applied
6. Trane/Mitsubishi
7. York/Hitachi
8. Lennox

#### B. Manufactured Units:

1. Provide packaged, air-cooled, factory assembled, pre-wired and pre-piped unit consisting of cabinet, fans, filters, remote condensing unit, and controls. Wall-mounted units shall be furnished with integral wall mounting bracket and mounting hardware.
2. Assemble unit for wall-mounted or ceiling installation with service access required.
3. Performance shall be as scheduled on the drawings.
4. Unit shall be rated per AHRI Standards 210/240 and listed in the AHRI directory as a matched system.
5. Provide unit with factory-supplied cleanable air filters.
6. The units shall be listed by Electrical Laboratories (ETL) in accordance with UL-1995 certification and bear the ETL label.
7. All wiring shall be in accordance with the National Electric Code (NEC).

#### C. Evaporator Cabinet and Frame:

1. Cabinet:

- a. Refer to schedule on drawings for mounting type (wall-mounted, or ceiling concealed).
- b. Exposed units shall have a finished appearance with concealed refrigerant piping, condensate drain piping, and wiring connections.

D. Evaporator Fans and Motors:

1. Fans:

- a. The evaporator fan shall be direct drive with a single motor having permanently lubricated bearings.
- b. The fan shall be statically and dynamically balanced.
- c. The indoor fan shall have at least three speeds.

2. Motor:

- a. Direct driven, digitally controlled with multiple speeds. Permanently lubricated with internal overload protection.

E. Evaporator Coils (Direct Expansion):

1. Direct expansion cooling coil of seamless copper tubes expanded into aluminum fins.
2. Single refrigeration circuit with externally equalized expansion valve.
3. Coils shall be pressure tested at the factory.
4. A sloped, corrosion-resistant condensate pan with drain shall be provided under the coil.

F. Electrical Panel:

1. Service Connections, Wiring, and Disconnect Requirements: Conform to the National Electrical Code and local electrical codes.

G. Control:

1. The unit shall have a hard-wired 7-day programmable remote controller to operate the system. Provide wall mounting bracket for controller.
2. Remote controller shall have "automatic", "dry" (dehumidification), and "fan only" operating modes.
3. The remote controller shall have the following features:
  - a. On/Off power switch.
  - b. Mode Selector to operate the system in auto, cool, heat, fan, or dehumidification (dry) operation.
  - c. Fan Setting to provide multiple fan speeds.
  - d. Swing Louver for adjusting supply louver discharge.
  - e. On/Off Timer for automatically switching the unit off or on.
  - f. Temperature Adjustment allows for the increase or decrease of the desired temperature.
  - g. Powerful Operation to allow quick cool down or heating up in the desired space to achieve maximum desired temperature in the shortest allowable time.
4. The remote controller shall perform fault diagnostic functions that may be system related, indoor or outdoor unit related depending on the fault code.

5. Temperature range on the remote controller shall be 64°F to 90°F in cooling mode and 50°F to 86°F in heating mode.
6. The indoor unit microprocessor shall have the capability to receive and process commands via return air temperature and indoor coil temperature sensors enabled by commands from the remote controller.

H. Outdoor Unit:

1. General:
  - a. The outdoor unit shall be specifically matched to the corresponding indoor unit size. The outdoor unit shall be completely factory assembled and pre-wired with all necessary electronic and refrigerant controls.
2. Cabinet:
  - a. The outdoor unit shall be fabricated of galvanized steel, bonderized and coated with a baked enamel finish for corrosion protection.
3. Fan:
  - a. The fan shall be direct drive, propeller type fan with fan guard.
  - b. Fan blades shall be statically and dynamically balanced.
  - c. The fan shall have permanently lubricated type bearings.
  - d. Motor shall be protected by internal thermal overload protection.
  - e. Airflow shall be horizontal discharge.
4. Coil:
  - a. The outdoor coil shall be nonferrous construction with corrugated fin tube.
  - b. The coil shall be protected with an internal guard.
  - c. Refrigerant flow from the condenser shall be controlled via a metering device.
5. Compressor:
  - a. Hermetic or scroll refrigerant compressors with resilient suspension system, inverter driven, oil strainer, sight glass/moisture indicator, internal motor protection, high pressure switch, and crankcase heater.
  - b. The outdoor unit shall have an accumulator and four-way reversing valve.
6. Refrigerant:
  - a. Unit shall use R-410a.
  - b. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.

I. Integral Condensate Pump:

1. Packaged unit matched to evaporator unit including float switch, pump, motor assembly, check valve, and reservoir.
2. Provide alarm to indicate high level reservoir.
3. Unit shall be powered from evaporator unit with appropriate field connections available.



## **2.02 PIPING**

- A. Design Pressure: 450 psig; Maximum Design Temperature: 250°F
- B. Type ACR Seamless Copper Tube Linesets; Brazed Joints:
  - 1. 3/4" and under.
  - 2. Tubing: Type ACR seamless copper tube linesets, ASTM B1003. Sizes indicated are nominal designation.
  - 3. Joints: Brazed with silver solder.
  - 4. Fittings: Wrought copper solder joint, ANSI B16.22.
  - 5. Special Requirements: All tubing shall be cleaned, dehydrated, pressurized with dry nitrogen, plugged, and tagged by manufacturer "for refrigeration service". During brazing operations, continuously purge the interior of the pipe with nitrogen to prevent oxide formation.
  - 6. Limitations:
    - a. Only between refrigerant splitter box and indoor terminal unit.
    - b. For use above ceiling only. Do not use in exposed areas.
- C. Type ACR Hard Drawn Seamless Copper Tube; Brazed Joint:
  - 1. 4" and under.
  - 2. Tubing: Type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation.
  - 3. Joints: Brazed with silver solder.
  - 4. Fittings: Wrought copper solder joint, ANSI B16.22.
  - 5. Special Requirements: All tubing shall be cleaned, dehydrated, pressurized with dry nitrogen, plugged and tagged by manufacturer "for refrigeration service". During brazing operations, continuously purge the interior of the pipe with nitrogen to prevent oxide formation.
- D. Refrigerant linesets are permitted.
  - 1. Provide manufacturer-packaged refrigerant linesets and accessories of sizes needed for installation. Verify lengths of piping required for installation.

## **2.03 INSULATION**

- A. EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Minimum 1/2" thick for pipe sizes less than 1-1/4" and 3/4" thick for pipe sizes 1-1/4" and above.

## **2.04 ROOF MOUNTING CURB**

- A. Curb height as shown on drawings., minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood nailer.

## **2.05 EXPANSION COMPENSATION**

- A. Assembly consisting of two flexible connectors, two copper flexible connectors, two 90° elbows, and a 180° return pipe. Unit shall be in the form of a pipe loop.
- B. Connectors shall have corrugated copper hose bodies with copper braided casings.
- C. Connectors shall be rated for 150 psi working pressure at 70°F.
- D. Sizes 2" and smaller shall have copper sweat ends.
- E. Connectors shall be suitable for 1/2" permanent misalignment.
- F. Manufacturer:
  - 1. Metraflex Type MLS

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that proper power supply is available.

### **3.02 INSTALLATION**

- A. General Installation Requirements:
  - 1. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
  - 2. Install units in accordance with manufacturer's instructions. Install all units level and plumb. Indoor units shall be installed using manufacturer's standard mounting hardware securely fastened to building structure.
  - 3. Refer to Section 23 0529 for roof support rails for outdoor unit.
  - 4. Coordinate the exact mounting location of all indoor and outdoor units with architectural and electrical work. Coordinate installation of ceiling-mounted units with ceiling grid layout. Provide additional ceiling grid reinforcement or modification as required and coordinate the work with the GC. Locate the indoor unit where it is readily accessible for maintenance and filter changes. Where outdoor units are located on the roof, locate at least 10' from the roof edge.
  - 5. Verify locations of wall-mounted remote controllers with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Height above finished floor shall not exceed 48".
  - 6. Maintain minimum clearances to all equipment. Maintain manufacturer's minimum maintenance, and airflow clearances, and maintain minimum spaces about electrical equipment, whichever is greater.
    - a. 120V: 36" deep x 30" wide or the width of the panel whichever is wider.
    - b. 208V: 42" deep x 30" wide or the width of the panel whichever is wider.
    - c. 480V: 42" deep x 30" wide or the width of the panel whichever is wider.
- B. Condensate Removal:

1. Install condensate piping with trap and route from drain pan to nearest drain. Discharge to nearest code-approved receptor or to a properly vented indirect waste fitting. Flush all piping before making final connections to units.
- C. Comb all coils to repair bent fins.
  - D. Install new filters in the unit at Substantial Completion.
  - E. A factory-authorized service agent shall assist in commissioning the unit and inspecting the installation prior to startup. Submit startup report with O&M manuals.

### **3.03 REFRIGERANT PIPING**

- A. Install refrigerant piping from the indoor unit(s) to the condensing unit. Refrigerant pipe sizes, lengths, specialties and configurations shall be as recommended by the manufacturer. Evacuate refrigerant piping and fully charge system with refrigerant per manufacturer's requirements.
- B. Provide weather-tight insulated roof curb to accommodate refrigerant piping and conduit roof penetrations.
- C. Insulate all refrigerant piping. Both liquid and suction lines shall be insulated between the indoor and outdoor units.
- D. Joining of Piping:
  1. Brazed Joints:
    - a. Make up joints with brazing filler metal conforming to ANSI/AWS A5.8. Cut copper tubing ends perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt, and grease just prior to brazing. Apply flux evenly, but sparingly, to all surfaces to be joined. Brazing filler metal with a flux coating may also be used. Heat joints uniformly to proper brazing temperature so braze filler metal flows to all mated surfaces. Wipe excess braze filler metal, leaving a uniform fillet around cup of fitting.
    - b. Flux shall conform to ANSI/AWS A5.31.
    - c. Remove composition discs and all seals during brazing if not suitable for a minimum of 840°F or greater than the melting temperature of the brazing filler metal, whichever is greater.
- E. Insulation:
  1. Insulate all refrigerant pipes between the heat pump and indoor units. This includes the liquid pipe, the suction pipe, the hot gas pipe, and the high/low pressure gas pipe. All fittings, valves, and specialty refrigerant components in the piping between the indoor and heat pump units shall also be insulated. The insulation shall have a continuous vapor barrier and shall pass through hangers and supports unbroken. All exterior insulated piping shall be painted with minimum of one (1) coat of UV resistant paint. Over size hangers and supports to allow the insulation to pass through unbroken. Following are the minimum insulation thicknesses unless noted otherwise in the manufacturer's literature or required by local AHJ:
    - a. Code/Year: IECC 2018

- b. Refrigerant Suction (40°F & Below):
  - 1) Up to 1": 1/2"
  - 2) 1" and up: 1"
  
- c. Refrigerant Suction (41°F to 60°F):
  - 1) Up to 1-1/2": 1/2"
  - 2) 1-1/2" and up: 1"
  
- d. Refrigerant Low Pressure Gas (141°F to 200°F):
  - 1) Up to 1-1/2": 1-1/2"
  - 2) 1-1/2" and up: 2"
  
- e. Refrigerant High Pressure Gas (201°F to 250°F):
  - 1) Up to 4": 2-1/2"
  
- f. Refrigerant Liquid:
  - 1) Up to 1-1/2": 1"
  - 2) 1-1/2" and up: 1-1/2"

**END OF SECTION**

## SECTION 23 8200 - TERMINAL HEAT TRANSFER UNITS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Unit Heaters.

#### 1.02 QUALITY ASSURANCE

- A. All filters shall be UL listed Class 1 or Class 2.
- B. All electrical equipment shall have a UL label.
- C. All louvers and dampers shall have AMCA certified ratings.
- D. Factory wired equipment shall conform to ANSI/NFPA 70.

#### 1.03 REFERENCES

- A. ANSI/ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ANSI/NFPA 70 - National Electrical Code.
- D. ASHRAE 200 - Methods of Testing Chilled Beams

#### 1.04 SUBMITTALS

- A. Submit shop drawings per Section 23 0500.
- B. Submit catalog data including arrangements, cross sections of cabinets, grilles, bracing, typical elevations.
- C. Submit schedules of equipment and enclosures indicating length, number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, and comparison of specified to actual heat output.
- D. Indicate mechanical and electrical service locations and requirements. Show deviations from scheduled products.
- E. Submit manufacturers' installation instructions.
- F. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

**1.05 DELIVERY, STORAGE AND HANDLING**

- A. Protect units from physical damage by storing in protected areas and leaving factory covers in place.

**1.06 REGULATORY REQUIREMENTS**

- A. Conform to ASHRAE 90.1.

**1.07 OPERATION AND MAINTENANCE DATA**

- A. Submit manufacturer's operation and maintenance data. Include operating, installation, maintenance and repair data, and parts listings.

**PART 2 - PRODUCTS**

**2.01 UNIT HEATERS**

- A. Casings shall be heavy gauge steel with a baked finish.
- B. Coils shall have copper heads and tubes, and aluminum fins.
- C. Units shall have threaded pipe connections for hanger rods.
- D. Fans shall be direct drive propeller type, factory balanced, with fan guards and totally enclosed motors with integral thermal overload protection.
- E. Horizontal units shall have adjustable outlet air louvers.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. General Installation Requirements:
  - 1. Install all products per manufacturers' instructions.
  - 2. Coordinate recess sizes for recessed equipment.
  - 3. Protect units with protective covers during construction.
  - 4. Comb all coils to repair bent fins.
- B. Unit Heater:
  - 1. Hang unit heaters from building structure, not from piping. Mount as high as possible within manufacturer's recommended mounting height requirements. If unit heaters cannot be installed within manufacturer's recommended range, notify Architect/Engineer prior to mounting.

**3.02 CLEANING**

- A. After construction is complete, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets, with materials furnished by manufacturer.
- C. Install new filters.

**END OF SECTION**

## SECTION 26 0500 - BASIC ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements. This section is also applicable to Interior Communications Pathways Section 27 0528. This section is also applicable to Fire Alarm and Detection Systems Section 28 3100.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

#### 1.02 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)

#### 1.03 SCOPE OF WORK

- A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.
- B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Electrical Work a finished and working system.
- C. Separate contracts will be awarded for the following work.
- D. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- E. Separate contracts will be awarded for the following work. The division of work listed below is for the contractors' convenience and lists a normal breakdown of the work. Please refer to the Construction Manager's scope statements for complete scope of work description.
- F. Description of Systems shall be as follows:
  - 1. Electrical power system to and including luminaires, equipment, motors, devices, etc.
  - 2. Electrical power service system from the Utility Company to and including service entrance equipment, distribution and metering.
  - 3. Grounding system.
  - 4. Wiring of equipment furnished by others.
  - 5. Telecommunications rough-in, as shown on drawings, for installation of telecommunications equipment by others under separate contract.
  - 6. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
- G. Work Not Included:
  - 1. Telecommunications cabling will be by others, in raceways and conduits furnished and installed as part of the Electrical work.



2. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) will be by other Contractors.

#### **1.04 OWNER FURNISHED PRODUCTS**

- A. The Owner will supply manufacturer's installation data for Owner-purchased equipment for this project.
- B. This Contractor shall make all electrical system connections shown on the drawings or required for fully functional units.
- C. This Contractor is responsible for all damage to Owner furnished equipment caused during installation.

#### **1.05 WORK SEQUENCE**

- A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours are required.
- B. Itemize all work and list associated hours and pay scale for each item.

#### **1.06 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, and CONTROL CONTRACTORS**

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
  1. "Mechanical Contractors" refers to the Contractors listed in Division 21/22/23 of this Specification.
  2. "Technology Contractors" refers to the Contractors furnishing and installing systems listed in Division 27/28 of this Specification.
  3. Motor Power Wiring: The single phase or 3 phase wiring extending from the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.
  4. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.
  5. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
  6. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.

7. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.
8. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
9. Low Voltage Technology Wiring: The wiring associated with the technology systems, used for analog or digital signals between equipment.
10. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation or mounting of telecommunications/technology information outlets.

C. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall furnish complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
4. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
  - a. Luminaires.
  - b. Gravity flow piping, including steam and condensate.
  - c. Electrical bus duct.
  - d. Sheet metal.
  - e. Cable trays, including access space.
  - f. Other piping.
  - g. Conduits and wireway.

D. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment furnished by the Mechanical Contractor.
2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.

3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Temperature Control Contractor's or Subcontractor's Responsibility:

1. Wiring of all devices needed to make the Temperature Control System functional.
2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.
3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

F. Electrical Contractor's Responsibility:

1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.
2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.
4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of the Fire Alarm System.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

## 1.07 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect/Engineer will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer are acceptable.

2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Shiprock Codes, Laws, Ordinances and other regulations having jurisdiction.
2. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
3. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
4. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
5. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
6. If there are no local codes having jurisdiction, the current issue of the National Electrical Code shall be followed.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.
8. Pay all telephone company charges related to the service or change in service.

E. Utility Company Requirements:

1. Secure from the private or public utility company all applicable requirements.
2. Comply with all utility company requirements.
3. The Owner shall make application for and pay for new electrical service equipment and installation. The Contractor shall coordinate schedule and requirements with the Owner and Utility Company.
4. The contractor is responsible for completing utility requested forms and sharing utility requested load data from the construction documents.
5. Furnish the metering compartment with CT space within the main switchboard. Verify approved manufacturers and equipment with the Utility Company.
6. The Owner shall apply and pay for any changes for removal of existing electrical service by the utility company. The Contractor shall verify approved manufacturers and equipment with the Utility Company.

F. Examination of Drawings:

1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

H. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

**1.08 SUBMITTALS**

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
26 05 03	Through Penetration Firestopping
26 05 13	Wire and Cable
26 05 23	Manufactured Wiring Assemblies
26 05 26	Grounding and Bonding
26 05 33	Conduit and Boxes
26 05 35	Surface Raceways
26 05 36	Cable Trays
26 05 37	Manholes
26 05 48	Seismic Requirements for Equipment and Supports
26 05 73	Power System Study
26 09 33	Lighting Control System
26 27 26	Wiring Devices
26 27 29	Electric Vehicle Charging Station
26 28 13	Fuses
26 28 16	Disconnect Switches
26 28 21	Contactors
26 32 13	Packaged Engine Generator Systems
26 43 00	Surge Protection Devices
26 51 19	LED Lighting
Drawings	Photocells, Timeclocks, Relays

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:
  - a. Date
  - b. Project title and number
  - c. Contractor's name and address
  - d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
  - e. Description of items submitted and relevant specification number
  - f. Notations of deviations from the contract documents
  - g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
  - a. Date
  - b. Project title and number
  - c. Architect/Engineer
  - d. Contractor and subcontractors' names and addresses
  - e. Supplier and manufacturer's names and addresses
  - f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
  - g. Description of item submitted (using project nomenclature) and relevant specification number
  - h. Notations of deviations from the contract documents
  - i. Other pertinent data
  - j. Provide space for Contractor's review stamps
  
3. Composition:
  - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
  - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
  - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
  
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
  
5. Contractor's Approval Stamp:
  - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
  - b. Unstamped submittals will be rejected.
  - c. The Contractor's review shall include, but not be limited to, verification of the following:
    - 1) Only approved manufacturers are used.
    - 2) Addenda items have been incorporated.
    - 3) Catalog numbers and options match those specified.
    - 4) Performance data matches that specified.
    - 5) Electrical characteristics and loads match those specified.
    - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
    - 7) Dimensions and service clearances are suitable for the intended location.
    - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.

- 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
  - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
  - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
  - b. The Contractor shall clearly indicate the size, finish, material, etc.
  - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
  - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
  8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
  9. Reproduction of contract documents alone is not acceptable for submittals.
  10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
  11. Submittals not required by the contract documents may be returned without review.
  12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
  13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
  14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
  15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
    - a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal, excluding mailing.
  16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.



2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
  - a. Submittal file name: 26 XX XX.description.YYYYMMDD
  - b. Transmittal file name: 26 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

## **1.09 SCHEDULE OF VALUES**

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
  1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
  2. Submit in Excel format.
  3. Support values given with substantiating data.
- C. Preparation:
  1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
  2. Break down all costs into:
    - a. Material: Delivered cost of product with taxes paid.
    - b. Labor: Labor cost, excluding overhead and profit.
  3. Itemize the cost for each of the following:
    - a. Overhead and profit.
    - b. Bonds.
    - c. Insurance.
    - d. General Requirements: Itemize all requirements.
  4. For each line item having an installed cost of more than \$5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:
    - a. Each piece of equipment requiring shop drawings. Use the equipment nomenclature (SB-1, PANEL P-1, etc.) on the Schedule of Values.
    - b. Each type of small unitary equipment (e.g., FDS, FCS, CS, etc.). Multiple units of the same type can be listed together provided quantities are also listed so unit costs can be determined.

- c. Each conduit system (medium voltage, normal, emergency, low voltage systems, etc.). In addition, for larger projects breakdown the material and labor for each conduit system based on geography (building, floor, and/or wing).
- d. Fire alarm broken down into material and labor for the following:
  - 1) Engineering
  - 2) Controllers, devices, sensors, etc.
  - 3) Conduit
  - 4) Wiring
  - 5) Programming
  - 6) Commissioning
- e. Site utilities (5' beyond building)
- f. Seismic design
- g. Testing
- h. Commissioning
- i. Record drawings
- j. Punchlist and closeout

D. Update Schedule of Values when:

- 1. Indicated by Architect/Engineer.
- 2. Change of subcontractor or supplier occurs.
- 3. Change of product or equipment occurs.

#### **1.10 CHANGE ORDERS**

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

#### **1.11 PRODUCT DELIVERY, STORAGE, HANDLING and MAINTENANCE**

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.
- B. Keep all materials clean, dry and free from damaging environments.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

## **1.12 NETWORK / INTERNET CONNECTED EQUIPMENT**

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.
- B. The following network connected equipment shall be equipped with restricted access protocols:
  - 1. Adjustable trip overcurrent protection devices
  - 2. Power monitoring and control
  - 3. Electrical controls
  - 4. Lighting control system
  - 5. Variable frequency drives
  - 6. Package engine generator and remote annunciator
  - 7. Transfer switch and remote annunciator
  - 8. Static uninterruptible power supply (UPS)
  - 9. Fire alarm and automatic detection

## **1.13 WARRANTY**

- A. Provide two-year warranty for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

## **1.14 INSURANCE**

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

## **1.15 CONTINGENCY**

- A. Include in the Base Bid a contingency of 10 percent to be used only by change orders issued by the Architect/Engineer. The unused portion of the contingency shall be deducted from the Contract price before final payment is made.

## **1.16 MATERIAL SUBSTITUTION**

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality.

- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.
- D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on the Contractors part or on the part of other Contractors whose work is affected.
- E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

- A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

## **PART 3 - EXECUTION**

### **3.01 JOBSITE SAFETY**

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

### **3.02 EXCAVATION, FILL, BACKFILL, COMPACTION**

#### **A. General:**

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with the work.

#### **B. Excavation:**

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Architect/Engineer or their representative, and do no further work until the Architect/Engineer or their representative gives further instructions.
9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.
12. Mechanical excavation of the trench to line and grade where direct burial cables are to be installed is permitted provided the excavation is made to a depth to permit installation of the cable on a fine sand bed at least 3 inches deep.

#### **C. Dewatering:**

1. Furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. No rubbish or waste material is permitted for fill or backfill.
2. Provide all necessary sand and/or CA6 for backfilling.
3. Native soil materials may be used as backfill if approved by the Geotechnical Engineer.
4. Dispose of the excess excavated earth as directed.
5. Backfill materials (native soil material, sand, and/or CA6) shall be suitable for required compaction, clean and free of perishable materials, frozen earth, debris, earth with a high void content, and stones greater than 4 inches in diameter. Water is not permitted to rise in unbackfilled trenches.
6. Backfill all trenches and excavations immediately after installing of conduit, or removing forms, unless other protection is directed.
7. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Spread fill and backfill materials in 6" uniform horizontal layers with each layer compacted separately to required density.
8. For conduits that are not concrete encased, lay all conduits on a compacted bed of sand at least 3" deep. Backfill around conduits with sand, in 6" layers and compact each layer.
9. Conduits that are concrete encased or in a ductbank, conduit spacers, and cradles shall be installed on a bed of compacted CA-6 gravel. Refer to conduit section for backfilling and ductbank requirements.
10. Backfill with native soil material (if approved) or sand up to grade for all conduits under slabs or paved areas. All other conduits shall have sand backfill to 6" above the top of the conduit.
11. Place all backfill above the sand in uniform layers not exceeding 6" deep. Place then carefully and uniformly tamp each layer to eliminate lateral or vertical displacement.
12. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
13. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

F. Surface Restoration:

1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting and landscaping features removed or damaged to its original condition. At least 6" of topsoil shall be applied where disturbed areas are to be seeded or sodded. All lawn areas shall be sodded unless seeding is called out in the drawings or specifications.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition. Broken edges shall be saw cut and repaired as directed by Architect/Engineer.

### **3.03 PROJECT CLOSEOUT**

- A. The following paragraphs supplement the requirements of Division 1.
- B. IDPH Pre-Occupancy Requirements:
  - 1. Each Contractor must submit all forms and certifications required by IDPH relating to their work at 85% completion of the project or when directed by the Owner/Architect/Engineer.
- C. Final Jobsite Observation:
  - 1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.
  - 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
  - 3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.
  - 4. Contractor shall notify Architect/Engineer 48 hours prior to installation of ceilings or lay-in ceiling tiles.
- D. The following must be submitted before Architect/Engineer recommends final payment:
  - 1. Operation and maintenance manuals with copies of approved shop drawings.
  - 2. Record documents including marked-up or reproducible drawings and specifications.
  - 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
  - 4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and submit receipt to Architect/Engineer.
  - 5. Inspection and testing report by the fire alarm system manufacturer.
  - 6. Start-up reports on all equipment requiring a factory installation or start-up.

### **3.04 OPERATION AND MAINTENANCE MANUALS**

- A. General:
  - 1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
  - 2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.
- B. Electronic Submittal Procedures:
  - 1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
  - 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.

3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
  - a. O&M file name: O&M.div26.contractor.YYYYMMDD
  - b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copies of all factory inspections and/or equipment startup reports.
5. Copies of warranties.
6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
7. Dimensional drawings of equipment.
8. Detailed parts lists with lists of suppliers.
9. Operating procedures for each system.
10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
11. Repair procedures for major components.
12. Replacement parts and service material requirements for each system and the frequency of service required.
13. Instruction books, cards, and manuals furnished with the equipment.
14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.



### **3.05 INSTRUCTING THE OWNER'S REPRESENTATIVE**

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.
- D. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.
- E. Operating Instructions:
  - 1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
  - 2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

### **3.06 RECORD DOCUMENTS**

- A. The following paragraphs supplement Division 1 requirements.
- B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.
- F. Record actual routing of conduits exceeding 2 inches.

### **3.07 PAINTING**

- A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.

- B. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chipping, etc. If color option is specified or is standard to the unit, verify with the Architect the color preference before ordering.

### **3.08 ADJUST AND CLEAN**

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

### **3.09 SPECIAL REQUIREMENTS**

- A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.
- B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.
- D. Raceway and Cable Routing Restrictions: Raceways and cable are restricted from being routed in the following locations, unless serving the space or permitted by the authority having jurisdiction.
  - 1. Elevator hoistways.
  - 2. Exit enclosures.
  - 3. Other areas restricted by code.
  - 4. Technology, data, server rooms.
  - 5. Fire pump and sprinkler rooms.
  - 6. Normal power in emergency power equipment rooms: Limited to feeders and branch circuits serving the emergency power equipment located in the room.
  - 7. Emergency power in normal power equipment rooms: Limited to feeders and branch circuits serving the normal power equipment located in the room.

### **3.10 INDOOR AIR QUALITY (IAQ) MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION**

- A. Within the Limits of Construction:
  - 1. The Electrical Contractor shall coordinate all work with the contractor responsible for IAQ.
  - 2. The means, methods and materials used by the Electrical Contractor shall be coordinated with the contractor responsible for IAQ and shall comply with the IAQ requirements set forth in Division 1 and Division 21/22/23 of these specifications.

B. Outside the Limits of Construction:

1. IAQ shall be the responsibility of the electrical contractor for work that is required outside the limits of construction.
2. The Electrical Contractor is responsible for the IAQ set forth in Division 1 and Division 21/22/23 of these specifications.
3. The Electrical Contractor shall review and coordinate all IAQ plans and procedures with the owner's IAQ representative.

**3.11 SYSTEM STARTING AND ADJUSTING**

- A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.
- C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.
- D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

**3.12 FIELD QUALITY CONTROL**

- A. General:
  1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
  2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
  3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
  4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
  5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than Electrical Code Standards. Take readings between conductors, and between conductors and ground.
  6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.

B. Ground Resistance:

1. Conduct service ground resistance tests using an approved manufactured ground resistance meter. Submit to the Architect/Engineer a proposed test procedure including type of equipment to be used. (The conventional ohmmeter is not an acceptable device.)
2. Make ground resistance measurements during normal dry weather and not less than 48 hours after a rain. Ground resistance values shall be verified by the Architect/Engineer at the time the readings are taken.
3. If the ground resistance value obtained is more than the value set forth in Section 26 0526, the following shall be done to obtain the value given:
  - a. Verify that all connections in the service ground system are secure.
  - b. Increase the depth to which ground rods are driven by adding section lengths to the rods and retest. If the resistance is still excessive increase the depth by adding an additional rod section and retest.
  - c. If the resistance is still excessive, furnish and install additional ground rods, spaced not less than 20 feet from other ground rods unless otherwise noted on plans, and connect into the ground electrode system. Retest.
  - d. Review results with the Architect/Engineer.
4. Before final payment is made to the Contractor submit a written report to the Architect/Engineer including the following:
  - a. Date of test.
  - b. Number of hours since the last rain.
  - c. Soil condition at the time of the test in the ground electrode location. That is: dry, wet, moist, sand, clay, etc.
  - d. Diagram of the test set-up showing distances between test equipment, ground electrode, auxiliary electrodes, etc.
  - e. Make, model, and calibration date of test equipment.
  - f. Tabulation of measurements taken and calculations made.

C. Ground-Fault Equipment Performance Testing:

1. Test: Perform ground-fault performance testing when system is installed. The test process shall use primary current injection per manufacturer instruction and procedures. Perform test for the following:
  - a. Service disconnects
  - b. Solid state molded case circuit breakers and solid-state insulated case circuit breakers equipped with ground fault protection.
  - c. Fusible switches with ground fault relay protection.
  - d. Outside branch circuits and feeders.
  - e. Code required.
2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.

- D. Arc Energy Reduction Equipment Performance Testing:
  - 1. Test: Perform arc energy protection performance testing when system is installed. The test process shall use primary current injection or approved method per manufacturer instructions and procedures. Perform test for the following:
    - a. All arc energy reduction systems installed.
  - 2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.
- E. Other Equipment:
  - 1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.
- F. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Architect/Engineer or authority having jurisdiction deem necessary.
- G. Contractor shall thermographic study all electrical gear, switchboard, panelboards, etc. at the end of construction to identify any unusual conditions/heating within the equipment. Coordinate with Owner/Architect/Engineer to have an Owner/Architect/Engineer representative present during testing.
- H. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.
- I. Upon completion of the project, the Contractor shall provide amperage readings for all panelboards and switchboards and turn the results over to the Owner for "benchmark" amperages.

### **3.13 UTILITY REBATE**

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.
- B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

## READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
3. Smoke and fire/smoke dampers are wired and have been tested.
4. Per Section 26 0500, cable insulation test results have been submitted.
6. Per Section 26 0500, ground resistance test results have been submitted.
7. Operation and Maintenance manuals have been submitted as per Section 26 0500.
8. Bound copies of approved shop drawings have been submitted as per Section 26 0500.
9. Report of instruction of Owner's representative has been submitted as per Section 26 0500.
11. Start-up reports from factory representative have been submitted as per Section 26 0500.

Accepted by:

Prime Contractor \_\_\_\_\_

By \_\_\_\_\_ Date \_\_\_\_\_

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

**END OF SECTION**

## SECTION 26 0503 - THROUGH PENETRATION FIRESTOPPING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Through-Penetration Firestopping.

#### 1.02 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

#### 1.03 REFERENCES

- A. 2021 International Building Code

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

#### 1.05 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
  - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
  - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
  - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
  - 2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq.ft. at both ambient temperature and 400°F.

- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

## **1.06 MEETINGS**

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
  - 1. Review foreseeable methods related to firestopping work.
  - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

## **1.07 WARRANTY**

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
  - 1. 3M; Fire Protection Products Division
  - 2. Hilti, Inc.
  - 3. RectorSeal Corporation, Metacaulk
  - 4. Tremco; Sealant/Weatherproofing Division
  - 5. Johns-Manville
  - 6. Specified Technologies Inc. (S.T.I.)
  - 7. Spec Seal Firestop Products
  - 8. AD Firebarrier Protection Systems
  - 9. Wiremold/Legrand: FlameStopper
  - 10. Dow Corning Corp
  - 11. Fire Trak Corp



12. International Protective Coating Corp

## 2.02 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- E. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- F. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

### 1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

- a. F Rating = Floor/Wall Rating
- b. L Rating = Penetrations in Smoke Barriers

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

### 2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

- a. F Rating = Wall Rating
- b. L Rating = Penetrations in Smoke Barriers

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999

Penetrating Item	UL System No.
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

- a. F Rating = Wall/Floor Rating
- b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

\*Alternate method of firestopping is patching opening to match original rated construction.

- G. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- H. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

### **3.02 INSTALLATION**

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

### **3.03 CLEANING AND PROTECTING**

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

### **3.04 IDENTIFICATION**

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
  - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

### **3.05 INSPECTION**

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the contractor's expense.

**END OF SECTION**

## SECTION 26 0513 - WIRE AND CABLE

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Building wire
- B. Cabling for remote control, signal, and power limited circuits
- C. Fire rated and circuit integrity (CI) cable and assemblies
- D. Metal-clad cable (MC)
- E. Nonmetallic-sheathed cable (NM)

#### 1.02 RELATED WORK

- A. Section 26 0553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

#### 1.03 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)
- B. UL 44 - Thermoset-Insulated Wires and Cables
- C. UL 83 - Thermoplastic-Insulated Wires and Cables
- D. UL 854 - Service-Entrance Cables
- E. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords
- F. UL 2196 - Fire Resistive, Fire Resistant and Circuit Integrity Cables

### PART 2 - PRODUCTS

#### 2.01 BUILDING WIRE

- A. Feeders and Branch Circuits 8 AWG and larger: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.
- B. Feeders and Branch Circuits 8 AWG and larger in Underground Conduit: Copper, stranded conductor, 600-volt insulation, THWN or XHHW-2.
- C. Feeders and Branch Circuits 10 AWG and Smaller: Copper, solid or stranded conductor, 600-volt insulation, THHN/THWN, unless otherwise noted on the drawings. Aluminum, compact stranded conductor is not acceptable for feeder and branch circuits 6 AWG and smaller.

- D. Motor Feeder from Variable Frequency Drives: Copper conductor, 600-volt XHHW-2 insulation, stranded conductor, unless otherwise noted on the drawings. Three conductor stranded copper, 600-volt XHHW-2 insulation, with copper ground and overall helical copper tape shield. Shield shall be terminated at both ends of cable with an approved termination.
- E. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.
- F. Aluminum conductors are not to be used for feeds to motor loads.
- G. Each 120 and 277-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

## **2.02 CABLING FOR REMOTE CONTROL, SIGNAL, AND POWER LIMITED CIRCUITS**

- A. Wire for the following specialized systems shall be as designated on the drawings, or elsewhere in these specifications. If not designated on the drawings or specifications, the system manufacturer's recommendations shall be followed.
  - 1. Fire alarm
  - 2. Low voltage switching and lighting control
  - 3. Electronic control
  - 4. Other specialized cabling, signal, and power limited cabling. Refer to the appropriate Division 23, 27, or 28 requirements; including, but not limited, to the following:
    - a. Building Automation Systems and Controls, Division 23.
    - b. Information Technology Backbone and Horizontal Cabling, Division 27.
    - c. Television Distribution Systems CATV, Division 27.
    - d. Sound Masking Paging Systems, Professional Audio/Video, Division 27.
    - e. Electronic Access Control, Intrusion Detection Systems, Video Surveillance, Division 28.
    - f. Rescue Assistance Communication System, Division 28.

## **2.03 FIRE-RATED AND CIRCUIT INTEGRITY (CI) CABLE AND ASSEMBLIES**

- A. Properties and requirements of fire rated cables and assemblies:
  - 1. 2HR fire rated for horizontal and vertical installations.
- B. Acceptable fire-rated cables and listed assemblies:
  - 1. Feeder assembly located outside the structure (example: below finished grade), rated metal stud and drywall enclosure, or encased in concrete; minimum 2 inches of concrete).
  - 2. Exothermal Mat Material: Raceway / Cable protected with exothermic mat material, UL listed.
    - a. Install per manufacturer guidelines and requirements. Apply appropriate quantity of wrapped layers of material as required to achieve rating.
    - b. Contractor shall upsize cable / wiring / raceway sizes as required for derating.
    - c. Provide cable / wire ampacity derating calculations for each application, reference manufacturer for additional information, document and submit derated calculations as a shop drawing submittal for approval prior to installation. Minimum cable / wire derating shall be:

- 1) Individual conduit raceways (less than or equal to 4" trade size): 10%.
  - 2) Parallel conduit raceways associated with the same feeder and protected by a common installation assembly: 15%.
  - 3) Cable tray raceway: 50%.
- d. Manufacturer:
- 1) 3M Interam Endothermic Mat
  - 2) Or submitted for engineer review prior to bid.
3. Mineral Insulated Cables: Copper conductor, 600-volt insulation, rated 90°C, Type MI.
- a. Manufacturer:
- 1) Raychem Pyrotenax MI
4. MC Cable: Copper conductor, 600V thermoset, low smoke zero halogen silicone rubber insulation, continuously welded corrugated copper armor for equipment grounding conductor, rated 90°C, UL listed 2196. MC fire rated cable shall not be used for branch circuits that required redundant equipment ground paths per code.
- a. Manufacturers:
- 1) VITALink MC
  - 2) Draka Lifeline MC Series
5. Fire rated cable in EMT or IMC raceway: Copper conductor, 300-volt or ethernet power-limited circuit cables low smoke zero halogen (LSZH), rated 105°C. Assembly including raceway shall be UL listed 2196 and UL circuit integrity (FHIT).
- a. Manufacturers:
- 1) VITALINK CI/CIC or ethernet series
  - 2) Draka RHW-2 EMT Series
6. Fire rated cable in phenolic RTRC conduit: Copper conductor, 600-volt RHW-2 or RW90 low smoke zero halogen (LSZH) insulation, rated 90°C. Assembly shall be UL listed 2196 and UL circuit integrity (FHIT).
- a. Manufacturer:
- 1) Draka Lifeline RHW-2

#### **2.04 METAL-CLAD CABLE (MC)**

- A. Conductors shall be copper, 600-volt insulation, THHN. Metal clad cable shall be constructed in strict accordance with Underwriters Laboratories, Inc. Standard for Metal-Clad Cables, UL 15694, exterior of metal interlocked armor.
- B. Minimum conductor size for branch circuit wiring shall be 12 AWG, with larger wires used where specified.

- C. Metal-clad cables may be used for branch circuit wiring as defined in the Electrical Code, subject to acceptance by State and local codes.
- D. Metal-clad cable shall NOT be used for circuits serving the Essential Electrical System.

## **2.05 NONMETALLIC-SHEATHED CABLE**

- A. Nonmetallic-Sheathed Cable, Size 14 through 4 AWG:
  - 1. Copper conductor, 600-volt insulation, rated 90°C, Type NM. Nonmetallic-sheathed cable shall be constructed in strict accordance with Underwriters Laboratories, Inc. Standard for Nonmetallic-sheathed Cables, UL 719.
  - 2. An equipment grounding conductor shall be provided with circuit conductors in all cables. Size per Electrical Code.
  - 3. Nonmetallic-sheathed cables may be used for branch circuit wiring as defined in the Electrical Code. Nonmetallic-sheathed cables shall not be used for other circuits.
- B. Underground Feeder and Branch Circuit Cable: Copper conductor, 600-volt insulation, rated 60°C, Type UF.
- C. Service Entrance Cable: Copper conductor, 600-volt insulation, XHHW, Type USE.

## **PART 3 - EXECUTION**

### **3.01 WIRE AND CABLE INSTALLATION SCHEDULE**

- A. Above Accessible Ceilings:
  - 1. Building wire shall be installed in raceway.
  - 2. Metal clad cable, Type MC, 1/2" size with minimum #12 conductors and ground, shall be allowed for flexible whips to individual luminaires on non-essential circuits. The flexible whips shall be between 18" to 72" in length per Electrical Code.
- B. All Other Locations: Building wire in raceway.
- C. Above Grade: All conductors installed above grade shall be type "THHN".
- D. Underground or In Slab: All conductors shall be type "THWN".
- E. Low Voltage Cable (less than 100 volts): Low voltage cables in ducts, plenums, and other air handling spaces shall be plenum listed. Low voltage cables in non-accessible areas shall be installed in conduit. Low voltage cable may be installed without conduit in accessible areas using the following types of cable supports. Cable support types/systems shall comply with the warranty requirements of the low voltage cable manufacturer.
  - 1. J-hooks
  - 2. Bridle rings with saddle supports
- F. Low Voltage Cable (less than 100 volts): Low voltage cable shall be installed in raceway.
- G. Fire-Rated 2-Hour Feeders and Circuit Requiring Continuous Operation (CI): Refer to Part 2 of this section for acceptable products and assemblies. Installation shall meet UL 2196.



### **3.02 CONTRACTOR CHANGES**

- A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)). Service entrance and fire pump feeder conductors are based on copper conductor installed in underground electrical ducts, NEC Table B.2(7) (2011 - 2017 edition Table B310.15(B)(2)(7); 2008 or later edition B.301.7) or calculated in accordance with Annex B Application Information for Ampacity Calculation..
- B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.
- C. Underground electrical duct ampacity rating shall be in accordance with NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)) or calculated in accordance with Annex B Application Information for Ampacity Calculation. The calculations and a sketch of the proposed installation shall be submitted prior to any conduit being installed.
- D. Conductor length(s) listed on plans and schedules. The drawings are diagrammatic with intent to convey the components of the electrical distribution system. Conductor length(s) when listed on plans and schedules are for engineering calculation purposes. Conductor length(s) shall NOT be used for bidding purposes.
- E. Record drawing shall include the calculations and sketches.

### **3.03 GENERAL WIRING METHODS**

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
- B. Use no wire smaller than 18 AWG for low voltage control wiring below 100 volts.
- C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet.
- D. Use no wire smaller than 8 AWG for outdoor lighting circuits.
- E. The ampacity of multiple conductors in one conduit shall be derated per the Electrical Code. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.
- F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.
- G. Splice only in junction or outlet boxes.
- H. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- I. Make conductor lengths for parallel circuits equal.
- J. All conductors shall be continuous in conduit from last outlet to their termination.
- K. Terminate all spare conductors on terminal blocks, and label the spare conductors.

- L. Cables or wires shall not be laid out on the ground before pulling.
- M. Cables or wires shall not be dragged over earth or paving.
- N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.
- O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.
- P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

### **3.04 WIRING INSTALLATION IN RACEWAYS**

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.
- D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.
- E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.
- F. Only nylon rope shall be permitted to pull cables into conduit and ducts.
- G. Completely and thoroughly swab raceway system before installing conductors.
- H. Conductor Supports in Vertical Raceways:
  - 1. Support conductors in vertical raceways in accordance with the Electrical Code Spacing of Conductors Supports.
  - 2. Supports shall be of insulated wedge type (OZ Gedney Type S, or equal) and installed in a tapered insulated bushing fitting or a metal woven mesh with a support ring that fits inside conduit fitting installed in an accessible junction box (Hubbell Kellems support grip or equal).

### **3.05 CABLE INSTALLATION**

- A. Provide protection for exposed cables where subject to damage.
- B. Use suitable cable fittings and connectors.

- C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.
- D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.
- E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.
- F. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.
- G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

### **3.06 FIRE-RATED CABLE AND ASSEMBLY INSTRUCTIONS**

- A. Terminations of the fire-rated cable must be outside of the fire zone.
- B. Fire-rated cable shall be installed according to the manufacturer's instructions, recommendations, and UL listing.
- C. Route fire-rated cable and assemblies separate from other feeders and distribution. Install cable and assemblies in locations protected from physical damage.
- D. Refer to Electrical Identification Section 26 0553 for specific identification requirements.

### **3.07 WIRING CONNECTIONS AND TERMINATIONS**

- A. Splice and tap only in accessible junction boxes.
- B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.
- C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.
- D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

- E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor. Cold shrink connector insulator with 1kV rating shall be used in damp and wet locations.
- F. Thoroughly clean wires before installing lugs and connectors.
- G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.
- I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:
  - 1. Facing the front and operating side of the equipment, the phase identification shall be:
    - a. Left to Right - A-B-C
    - b. Top to Bottom - A-B-C
- J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.
- K. Use antioxidant joint compound on all aluminum conductor terminations. Apply antioxidant joint compound per manufacturer's recommendations.

### **3.08 AC, MC, AND NONMETALLIC-SHEATHED CABLE INSTALLATION**

- A. AC/MC shall NOT be used for circuits serving the Essential Electrical System.
- B. Cable shall be supported by an approved means every 4.5' and within 12" of outlet boxes, junction boxes, cabinets, or fittings.
- C. Cable may be unsupported in the following conditions:
  - 1. Cable is no longer than 2' in length at terminals where flexibility is necessary.
  - 2. Cable is not more than 4.5' from the last point of support for connections within an accessible ceiling to light fixtures or equipment.
- D. Conductor ampacity shall be derated as required by the Electrical Code where more than three current carrying conductors are used.
- E. Each 120 and 277-volt circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for cable derating.
- F. Cables shall be cut using a rotary cutter as recommended by the manufacturer to eliminate nicking and cutting of the conductors.
- G. Bending radius shall comply with the requirements listed in the Electrical Code for the type and size of cable being installed, but shall not be less than 5-times the diameter of the cable in any case.

- H. At cable terminations, a fitting shall be provided to protect wires from abrasion, unless the design of the outlet boxes or fittings is such as to afford equivalent protection, and, in addition, an insulating bushing or its equivalent protection shall be provided between the conductors and the armor.
- I. All wiring devices supplied by nonmetallic-sheathed cables shall be mounted in an outlet box.

### **3.09 FIELD QUALITY CONTROL**

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.
- C. MI cable shall have the insulation resistance of each cable tested with a 500-volt dc megohmmeter prior to energizing the cables. Tabulate resistance values and submit to Architect/Engineer for acceptance.
- D. Inspect wire and cable for physical damage and proper connection.
- E. Torque test conductor connections and terminations to manufacturer's recommended values.
- F. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.
- G. Provide documentation of the manufacturer's recommended lug torque value for copper and aluminum conductors, the date the lugs were torqued, and installed torque readings. Documentation indicating that the torque wrench has been calibrated not more than 30 days prior to tightening of lugs shall be provided.
- H. Protection of wire and cable from foreign materials:
  - 1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.
- I. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

**END OF SECTION**

## SECTION 26 0526 - GROUNDING AND BONDING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Equipment grounding system
- B. Grounding electrode system
- C. Grounding of systems over 1kV

#### 1.02 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 Grounding and Bonding Equipment.
- C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.
- D. Comply with Electrical Code; for overhead-line construction and medium-voltage underground construction, comply with IEEE/ANSI C2 National Electrical Safety Code (NESC).

#### 1.03 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)

#### 1.04 SUMMARY

- A. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

### PART 2 - PRODUCTS

#### 2.01 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section 26 0513 "Wire and Cable".
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated. Refer to Section 26 0553 for insulation color.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

G. IBT; Intersystem Bonding Termination:

1. Copper bar, 1/4" x 2" x 24". Provide with wall mounting brackets, insulators and pre-tapped holes.
2. Manufacturers:
  - a. Harger GBI Series.
  - b. Erico EGB Series.

## 2.02 GROUNDING ELECTRODES

- A. Concrete-Encased Grounding Electrode (Ufer): Fabricate according to Electrical Code, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG or 20 feet of 1/2" steel reinforcing bar.

## PART 3 - EXECUTION

### 3.01 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  2. Make connections with clean, bare metal at points of contact.
  3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- C. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

- D. Underground Connections: Exothermic-welded connections. Use for underground connections, except those at test wells.
- E. Connections at back boxes, junction boxes, pull boxes, and equipment terminations: The equipment grounding conductor(s) associated with all circuits in the box shall be connected together and to the box using a suitable grounding screw. The removal of the respective receptacle, luminaire, or other device served by the box shall not interrupt the grounding continuity. The connection to the non-metallic boxes shall be made to any metallic fitting or device requiring grounding.
- F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### **3.02 INSTALLATION**

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Each grounding conductor that passes through a below grade wall must be provided with a waterstop.
- C. Grounding electrode conductor (GEC) shall be protected from physical damage by rigid polyvinyl chloride conduit (PVC) in exposed locations.
- D. In raceways, use insulated equipment grounding conductors.
- E. Underground Grounding Conductors: Use tinned copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

### **3.03 EQUIPMENT GROUNDING SYSTEM**

- A. Install equipment grounding conductors in all feeders and circuits. Terminate each end on a grounding lug or bus.
- B. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- C. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

### **3.04 BONDING SYSTEM**

- A. At building expansion joints, provide flexible bonding jumpers to connect to columns or beams on each side of the expansion joint.



- B. Isolated Equipment Enclosure: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment bonding conductor.
- C. Exterior Metallic Pull and Junction Box Covers, Metallic Hand Rails: Bond to grounding system using flexible grounding conductors.
- D. Bond metal ducts of dust collectors, particulate conveying, fume hoods, and other hazardous materials to the equipment grounding conductors of associated pumps, fans, or blowers. Use braided-type bonding straps. Provide braided bare copper bonding conductor in nonmetallic dust collector ductwork to each equipment inlet location, and bond to equipment.
- E. Water Heater, Heat-Tracing, Metal Well Casing, and Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and anti-frost heating cable. Bond conductor to heater units, piping, well casing, connected equipment, and components.
- F. Connect bonding conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.
- G. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 6 AWG minimum insulated bonding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location. Leave 10 feet of slack conductor at terminal board.
- H. Telecom Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bar.
- I. Equipment Ground Conductor Continuity: All spliced equipment grounding conductors in junction boxes, cabinets, and distribution equipment shall be connected together and bonded to the metal enclosure.
- J. Remote control, signaling, and fire alarm circuits shall be bonded in accordance with the most recent version of the National Electric Code.
- K. Metal Poles Supporting Outdoor Lighting Fixtures > 15 feet: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.
- L. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- M. Medical Gas Piping: Bond to pipe with grounding clamp connectors. Bonding conductor shall be a #6 AWG minimum and may be connected to panelboard ground bar serving the area.

### **3.05 GROUNDING ELECTRODE SYSTEM**

- A. Ground Ring (Counterpoise):

1. Ground the steel framework of the building with a driven ground rod at the base of every corner column and at intermediate exterior columns at average distances not more than 60 feet apart. Provide a grounding conductor, electrically connected to each ground rod and to each steel column, extending around the perimeter of the building. Use tinned-copper conductor not less than No. 2 AWG for ground ring and for tap to building steel. Bury conductor not less than 30 inches below grade, 24 inches from building foundation, and 18 inches outside of roof drip line.
- B. Supplementary Grounding Electrode: Use driven ground rod on exterior of building.
- C. Provide bonding at Utility Company's metering equipment and pad mounted transformer.
- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters, filtering devices, and similar equipment. Connect to pipe with grounding clamp connectors.
- F. Natural Gas Service Piping: Bond to natural gas main service with grounding clamp connectors. Bonding conductor shall be connected to the main service ground bar. Provide grounding jumpers around all breaks in metallic continuity.
- G. Natural Gas Equipment Piping: Bond each aboveground portion of natural gas metallic piping system at each equipment location with grounding clamp connectors. Bonding shall be performed after any flexible attachment nearest the equipment. The equipment grounding conductors may serve as the bonding means.
- H. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.
- I. Concrete-Encased Grounding Electrode (Ufer): Install concrete-encased grounding electrode encased in at least 2 inches of concrete horizontally within the foundation that is in contact with the earth. If concrete foundation is less than 20 feet long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

### **3.06 CONCRETE OR WOOD BUILDING GROUNDING SYSTEM**

- A. Provide a copper common grounding electrode conductor for the attachment of multiple separately derived systems in accordance with Electrical Code. Individual grounding conductor taps from the separately derived systems to the common grounding electrode shall be sized in accordance with Electrical Code. All tap connections shall be made in an accessible location in such a manner that common grounding electrode conductor remains without a splice or joint.

### **3.07 EQUIPOTENTIAL (MULTI-POINT) GROUNDING SYSTEM**

- A. Provide an equipotential grounding system in the following locations:

1. Class I Div 1 and Div 2 locations as required in Electrical Code.
  2. Swimming pool, fountains, and similar locations as required in Electrical Code.
  3. Critical patient care and special care areas as indicated on drawings.
- B. The non-current-carrying metal parts of equipment, raceways and other enclosures shall be bonded to the grounding system.

### **3.08 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING**

- A. **Manholes and Handholes:** Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.
- B. **Connections to Manhole Components:** Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
- C. **Pad-Mounted Transformers and Switches:** Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 2 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches below grade and 6 inches from the foundation. The pad rebar shall be attached to the counterpoise conductor at the four corners.

### **3.09 OVERHEAD-LINE GROUNDING**

- A. Comply with IEEE C2 requirements. Use 2 or more parallel ground rods if a single ground rod electrode resistance to ground exceeds 25 ohms.
- B. Drive ground rods to a depth of 12 inches below finished grade in undisturbed earth.
- C. **Ground Rod Connections:** Use clamp-type connectors listed for the purpose for underground connections and connections to rods.
- D. **Lightning Arresters:** Separate arrester grounds from other grounding conductors.
- E. **Secondary Neutral and Tank of Transformer:** Interconnect and connect to grounding conductor.
- F. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

### **3.10 SUBSTATION GROUNDING**

- A. Provide an underground fence ground conductor, minimum 1/0 copper buried 18", located 3 feet outside the fence perimeter. Bond the fence ground grid into the substation ground grid. Ground fence at each side of gate or other openings. Gates shall be bonded to the grounding conductor, with a jumper to the gate. A buried bonding jumper shall be used across the gate or other openings. Provide an underground grounding conductor under the gate swing area. Barbed wire strands used above the fence fabric shall be bonded to the grounding conductor, jumper or fence. Fence posts shall be connected to the grounding conductor with suitable connecting means. Ground all corner posts and line post every 50 feet.
- B. Provide a substation underground ground grid of 4/0 bare stranded copper cable buried 18" below grade in a minimum 10' by 20' grid. Exothermic weld connections of 4/0 cables at all junctions.
- C. Provide grounding conductor for the grounded neutral for transformers, reactors and capacitors. Provide grounding conductor for lighting arrestors, gaps and similar devices. Provide grounding for all exposed metal parts of switches, structures, transformer tanks, metal walkway, steelwork of buildings, switchboards, instrument-transformer secondaries, etc.
- D. Provide two ground rods/chemical electrodes, or as shown on drawings. Connect to underground grounding conductor.

### **3.11 FIELD QUALITY CONTROL**

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
  - 1. Measure ground resistance from system neutral connection at service entrance to convenient ground reference points using suitable ground testing equipment. Resistance shall not exceed 5 ohms.
  - 2. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
  - 3. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
  - 4. Testing: Perform the following field quality-control testing:
    - a. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
    - b. 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. Measure ground resistance not less than two full days after the last trace of precipitation, and without the 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. Perform tests, by the fall-of-potential method according to IEEE 81.
    - c. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
      - 1) Equipment Rated 500 kVA and Less: 10 ohms.

- 2) Equipment Rated 500 to 1000 kVA: 5 ohms.
- 3) Equipment Rated More Than 1000 kVA: 3 ohms.
- 4) Substations and Pad-Mounted Switching Equipment: 5 ohms.
- 5) Manhole Grounds: 10 ohms.

- d. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect/Engineer promptly and include recommendations to reduce ground resistance.

### **3.12 GRADING AND PLANTING**

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2. Maintain restored surfaces. Restore disturbed paving.

**END OF SECTION**

## SECTION 26 0527 - SUPPORTING DEVICES

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Conduit and Equipment Supports
- B. Fastening Hardware
- C. Concrete Housekeeping Pads
- D. Foundation and Underground Sleeves and Seals

#### 1.02 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

#### 1.03 COORDINATION

- A. Coordinate size, shape and location of concrete pads with section on Cast-in-Place Concrete or Concrete Topping.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Allied Support Systems
- B. Cooper B-Line
- C. Erico, Inc.
- D. Hilti
- E. Power Fasteners
- F. Orbit Industries

#### 2.02 MATERIAL

- A. Support Channel: Hot-dip galvanized stainless steel for wet/damp locations; painted steel for interior/dry locations. All field cut ends shall be touched up with matching finish to inhibit rusting.
- B. Hardware: Corrosion resistant.
- C. Anchorage and Structural Attachment Components:

1. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to Authorities Having Jurisdiction.
  - a. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
2. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
3. Welding Lugs: Comply with MSS-SP-69, Type 57.
4. Beam clamps for Steel Beams and Joists: Double sided or concentric open web joist hangers. Single-sided type is not acceptable.
5. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
6. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.
7. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-020. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.
8. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

D. Conduit Sleeves and Lintels:

1. Each Contractor shall provide, to the General Contractor for installation, lintels for all openings required for the Contractor's work in masonry walls and conduit sleeves for floors, unless specifically shown as being by others.
2. Refer to Structural plans and specifications for lintel requirements and sizes.
3. Lintels:
  - a. Lintels in non-bearing masonry wall openings can be sized in accordance with the note below. Lintels that occur in existing bearing walls are to be sized according to similar conditions and spans in the new construction and lintel schedule. Bottom plate size shall be a minimum of 3/8" thick. The width of the plate shall be 3/4" less than the field verified wall thickness. The plate shall be the full length of the lintel member. Lintels are not required over openings that are 12" wide or less and at least 1 course below the top of the wall.
  - b. All lintels shall have a minimum of 8" end bearing.
  - c. All lintels in exterior wall construction shall be hot-dip galvanized.
  - d. For all openings not otherwise detailed or scheduled, minimum lintels shall be for each 4 inch of masonry width:
    - 1) 0 to 2'-0" span: 5/16" plate (3/4" less than wall width)
    - 2) 2'-0" to 4'-0" span: L 3 1/2 x 3 1/2 x 1/4
    - 3) 4'-0" to 6'-0" span: L4 x 3 1/2 x 5/16 (llv)
    - 4) 6'-0" to 8'-0" span: L5 x 3 1/2 x 5/16 (llv)
  - e. All angles that are back to back shall be welded top and bottom 3" at 12" minimum.
4. Fabricate all lintels from structural steel shapes or as indicated on the drawings. All lintels and grouped wall openings shall be approved by the Architect or Structural Engineer.

5. Fabricate all sleeves from standard weight black steel pipe. Provide continuous sleeve. Cut or split sleeves are not acceptable. Sleeves through concrete walls may be high density polyethylene pipe penetration sleeve with a water stop collar, suitable for use with Link-Seal mechanical seals. Century-Line Model CS.
6. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
7. Sleeves shall not penetrate structural members without approval from the Structural Engineer.
8. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
9. Install all sleeves concentric with conduits. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
10. Where conduits rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
11. Size sleeves large enough to allow expansion and contraction movement.

E. Concrete Housekeeping Pads:

1. Concrete bases for all floor mounted equipment and wall mounted equipment which is surface mounted and extends to within 6" of the finished floor, unless shown otherwise on the drawings, shall be 3-1/2" thick concrete.
2. Bases shall extend 3" on all sides of the equipment (6" larger than factory base).
3. Where the base is less than 12" from a wall, the base shall be carried to the wall to prevent a "dirt-trap".
4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6" x 6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at twenty-eight days.

F. Truss and Joist Support System: Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
  - a. The hanger is attached within 6" from a web/chord joint.
  - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.



## 2.03 FOUNDATION - UNDERGROUND SLEEVES AND SEALS

### A. Wall Seals ("Link-Seals"):

1. Where shown on the drawings, raceways passing through foundation walls to an underground condition shall have their annular space (sleeve or drilled hole – not tapered hole made with knockout plug) sealed by properly sized sealing element consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve.
3. Sleeves shall be at least 2 trade sizes larger than the penetrating raceway.
4. Pressure shall be maintained by stainless steel bolts and accessories. Pressure plates may be of composite materials for Models S and OS.
5. Sealing Elements shall be as follows:

Model	Service	Element Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant / Stainless	Nitrile	-40°F to 210°F

6. Approved Manufacturers:
  - a. Thunderline Corporation "Link-Seals"
  - b. O-Z/Gedney Company
  - c. Calpico, Inc
  - d. Innerlynx

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.
- B. Trapeze support installation: Cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- C. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- D. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.
- E. Do not use powder-actuated anchors without specific permission.

- F. Do not drill structural steel members.
- G. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- H. In wet locations and on all building floors below exterior earth grade install free-standing electrical equipment on concrete pads.
- I. Install cabinets and panelboards with minimum of four anchors. Provide horizontal backing/support framing in stud walls for rigid mounting. Provide steel channel supports to stand surface-mounted panelboard or cabinet one inch off wall.
- J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- K. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- L. Refer to Section 26 0533 for special conduit supporting requirements.

### **3.02 FINISH**

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
- B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

**END OF SECTION**

## SECTION 26 0533 - CONDUIT AND BOXES

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Rigid metallic conduit and fittings (RMC)
- B. Stainless steel conduit (316SS) and fittings
- C. Intermediate metallic conduit and fittings (IMC)
- D. Electrical metallic tubing and fittings (EMT)
- E. Flexible metallic conduit and fittings (FMC)
- F. Liquidtight flexible metallic conduit and fittings (LFMC)
- G. Rigid polyvinyl chloride conduit and fittings (PVC)
- H. High density polyethylene conduit and fittings (HDPE)
- I. Reinforced thermosetting resin conduit (RTRC)
- J. Phenolic reinforced thermosetting resin conduit (Phenolic RTRC)
- K. Wall and ceiling outlet boxes
- L. Electrical connection
- M. Pull and junction boxes
- N. Rough-ins
- O. Handholes
- P. Accessories

#### 1.02 RELATED WORK

- A. Section 26 0553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

#### 1.03 REFERENCES

- A. American National Standards Institute (ANSI):
  1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
  2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
  3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
  4. ANSI C80.6 - Intermediate Metal Conduit, Zinc Coated

5. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
  6. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
- B. Federal Specifications (FS):
1. A-A-50553A - Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type
  2. A-A-55810 - Specification for Flexible Metal Conduit
- C. NECA "Standards of Installation"
- D. National Electrical Manufacturers Association (NEMA):
1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
  2. RN 1 - Polyvinyl chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit, Rigid Aluminum Conduit, and Intermediate Metal Conduit
  3. TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit
  4. TC 9 - Fittings for PVC Plastic Utilities Duct for Underground Installation
- E. NFPA 70 - National Electrical Code (NEC)
- F. Underwriters Laboratories (UL): Applicable Listings
1. UL 1 - Flexible Metal Conduit
  2. UL 6 - Rigid Metal Conduit
  3. UL 360 - Liquid Tight Flexible Steel Conduit
  4. UL514-B - Conduit Tubing and Cable Fittings
  5. UL651-A - Type EB and a PVC Conduit and HDPE Conduit
  6. UL651-B - Continuous Length HDPE Conduit
  7. UL746A - Standard for Polymeric Materials - Short Term Property Evaluations
  8. UL797 - Electrical Metal Tubing
  9. UL1242 - Intermediate Metal Conduit
- G. Definitions:
1. Fittings: Conduit connection or coupling.
  2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
  3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.
  4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
  5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
  6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.
  7. Slab: Horizontal pour of concrete used for a floor or sub-floor.

## **PART 2 - PRODUCTS**

### **2.01 RIGID METALLIC CONDUIT (RMC) AND FITTINGS**

- A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.

### **2.02 INTERMEDIATE METALLIC CONDUIT (IMC) AND FITTINGS**

- A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.

### **2.03 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS**

- A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.

### **2.04 FLEXIBLE METALLIC CONDUIT (FMC) AND FITTINGS**

- A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted. Lighting branch circuit wiring to an individual luminaire may be a manufactured, UL listed 3/8" flexible metal conduit and fittings with #14 AWG THHN conductors and an insulated ground wire. Maximum length of 3/8" FMC shall be six (6) feet.
- B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel. Provide a separate equipment grounding conductor when used for equipment where flexibility is required.

### **2.05 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS**

- A. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.

### **2.06 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS**

- A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.
- B. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.
- C. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.
- D. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

### **2.07 OUTLET BOXES**

- A. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.

- B. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of the required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls, boxes shall be installed in the block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.
- C. Outlet boxes for telephone substations in walls and columns shall be 4 inches square and 2-1/8 inches deep with single gang raised cover to fit flush with finished wall line equipped with flush telephone plate.
- D. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

## **2.08 ECONN; ELECTRICAL CONNECTION**

- A. Electrical connection to equipment and motors, sized per Electrical Code. Coordinate requirements with contractor furnishing equipment or motor. Refer to specifications and general installation notes for terminations to motors.

## **2.09 JB; PULL AND JUNCTION BOXES**

- A. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.
- B. Flanged type boxes shall be used where installed flush in wall.

## **2.10 ROUGH-IN**

- A. Provide with one (1) flush mount double gang box with single gang plaster ring and appropriate cover plate,
- B. Conduit stubbed to above the lay-in ceiling.

## **2.11 HANDHOLES**

- A. HH-#; Handhole, composite polymer concrete body and cover. Stainless steel hardware. Bolted non-skid cover rated for 5,000 pounds. Design load occasional non-deliberate vehicular traffic. Stack units to achieve depth shown on plans. Units in landscaped areas shall be green in color. 11"W, 18"L, 18"D or dimensions as shown on plans.

### **1. Manufacturers:**

- a. Hubbell/Quazite PG####BB18, PG####HA00
- b. Carson Industries H Series
- c. Armorcast
- d. Highline Products
- e. Synertech

## 2.12 ACCESSORIES

- A. Fire Rated Moldable Pads: UL #9700, moldable sheet putty at required thickness on all five sides of back boxes. Kinetics Noise Control - IsoBacker Pad, SpecSeal - SSP Putty and Pads, 3M #MPP-4S or equal.
- B. Sound Barrier Insulation Pads: Mastic, non-hardening, sheet material, minimum 1/8" thickness applied to all five sides of back boxes. Kinetics Noise Control - SealTight Backer Pad, L.H. DOTTIE Co., #68 or equal.

## PART 3 - EXECUTION

### 3.01 CONDUIT INSTALLATION SCHEDULE AND SIZING

- A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Architect/Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the Electrical Code shall be required.
- B. Installation Schedule: Refer to drawings.
- C. Fire Rated Assemblies:
  - 1. Listed Fire Rated Assemblies: Phenolic RTRC
- D. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to the Electrical Code. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the Electrical Code (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.
- E. Minimum Conduit Size (Unless Noted Otherwise):
  - 1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)
  - 2. Below Grade 5' or less from Building Foundation: 1 inch.
  - 3. Below Grade More than 5' from Building Foundation: 1 inch.
  - 4. Telecommunication Conduit: 1 inch.
  - 5. Controls Conduit: 3/4 inch.
- F. Conduit Embedded in Slabs above Grade:
  - 1. Embedded installation NOT allowed in elevated slabs with metal composite decks nor structural pour in place slabs less than 6 inches in depth unless specifically noted or shown on drawings otherwise.
  - 2. Maximum size 1-1/4 inch for conduits crossing each other.
- G. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

### **3.02 CONDUIT ARRANGEMENT**

- A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.
- B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Architect/Engineer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.
- C. Conduit arrangement in elevated slabs (restricted to applications specifically noted or shown on drawings):
  - 1. Conduit size shall not exceed one-third of the structural slab thickness. Place conduit between the top and bottom reinforcing with a minimum of 3" concrete cover.
  - 2. Parallel conduits shall be spaced at least 8 inches apart. Exception: Within 18 inches of commonly served floor boxes, junction boxes, or similar floor devices. Arrange conduits parallel or perpendicular to building lines and walls.
- D. Conduit shall not share the same cell as structural reinforcement in masonry walls.
- E. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.
- F. Contractor shall adapt Contractor's work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.
- G. Contractor shall cooperate with all contractors on the project. Contractor shall obtain details of other contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by Contractor. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

### **3.03 CONDUIT SUPPORT**

- A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.
  - 1. Support wire used to independently support raceway and wiring systems above suspending ceilings shall be supported on both ends, minimum 12 gauge suspended ceiling support wire, and distinguishable from ceiling support systems by color (field paint), tagging, or equivalent means.



- B. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Architect/Engineer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.
- C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.
- D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- E. Spring-steel conduit clips specifically designed for supporting single conduits or tubing may be used in lieu of malleable-iron hangers for 1-1/2" and smaller raceways serving lighting and receptacle branch circuits above accessible ceilings and for securing raceways to slotted channel and angle supports.
- F. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.
- G. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing or steel framing will need to be added.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the Electrical Code requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.
- J. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.
- K. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the Electrical Code requirements.
- L. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.
- M. Finish:
  1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
  2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

### 3.04 CONDUIT INSTALLATION

#### A. Conduit Connections:

1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.
4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.

#### B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.

#### C. Conduit Bends:

1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.
4. Telecommunications conduits shall have no more than two (2) 90-degree bends between pull points and contain no continuous sections longer than 100 feet. Insert pull points or pull boxes for conduits exceeding 100 feet in length.
  - a. A third bend is acceptable if:
    - 1) The total run is not longer than (33) feet.
    - 2) The conduit size is increased to the next trade size.
5. Telecommunications pull boxes shall not be used in lieu of a bend. Align conduits that enter the pull box from opposite ends with each other. Pull box size shall be twelve (12) times the diameter of the largest conduit. Slip sleeves or gutters can be used in place of a pull box.
6. Telecommunications Conduit(s): Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
7. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
8. Use conduit bodies to make sharp changes in direction (i.e. around beams).

#### D. Conduit Placement:

1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the Electrical Code.
2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
3. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.
5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
6. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls and floors, seal with a UL listed sealant. ; refer to Section 26 0503 for through penetration firestopping requirements.
7. **CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT THE EXPENSE OF THIS CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.**
8. Seal interior of conduit at exterior entries, air handling units, coolers/freezers, etc., and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, identified for use with cable and raceway system, equal to O-Z/Gedney type EYD.
9. Horizontal conduit routing through slabs above grade
  - a. No conduits are allowed to be routed horizontally through slabs above grade.
10. Do not route conduits across each other in slabs on grade.
11. Rigid polyvinyl chloride conduit (PVC) shall be installed when material surface temperatures and ambient temperature are greater than 40°F.
12. Where rigid polyvinyl chloride conduit (PVC) is used below grade, in a slab, below a slab, etc., a transition to rigid galvanized steel or PVC-coated steel conduit shall be installed before conduit exits earth. The metallic conduit shall extend a minimum of 6" into the surface concealing the non-metallic conduit.
13. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
14. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.
15. Telecommunications conduits that protrude through the structural floor shall be installed 1 to 3" above finished floor (AFF).
16. Telecommunications conduits that enter into Telecommunications rooms below the finished ceiling shall terminate a minimum of 4" below ceiling and as close to the wall as possible.
17. Telecommunications conduits that are below grade and enter into a building shall terminate a minimum of 4" above finished floor (AFF) and as close to the wall as possible.

### **3.05 CONDUIT TERMINATIONS**

- A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.
- B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.
- C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.
- D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.
- E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to roof exhaust fans, or other exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Motors in hazardous areas, as defined in the Electrical Code, shall be connected using flexible conduit rated for the environment. Flexible conduit shall not exceed 6' in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.
- F. Rigid polyvinyl chloride conduit (PVC) shall be terminated using fittings and bodies produced by the manufacturer of the conduit, unless noted otherwise. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.
- G. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

### **3.06 RIGID POLYVINYL CHLORIDE CONDUIT (PVC) OVERHEAD CONDUIT INSTALLATION**

- A. Conduit shall be installed away from high temperature piping and equipment.
- B. Conduit shall be installed to prevent exposure to ultraviolet radiation.
- C. Proper allowances shall be made for expansion and/or contraction of the conduit during installation.
- D. Expansion fittings shall be installed in any 100' continuous run of conduit and at each 100' thereafter.
- E. Supports shall be made from non-corroding materials and spacing shall not be greater than the listing in the Electrical Code, but also shall not exceed the manufacturer's recommendations depending on the expected surface temperature.

### **3.07 UNDERGROUND CONDUIT INSTALLATION**

- A. Conduit Connections:

1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.
- B. Conduit Bends (Lateral):
1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.
  2. Telecommunications conduit bend radius shall be six times the diameter for conduits under 2" and ten times the diameter for conduits over 2". Where long cable runs are involved, sidewall pressures may require larger radius bends. Coordinate with Architect/Engineer prior to conduit installation to determine bend radius.
- C. Conduit Elbows (vertical):
1. Minimum metal or RTRC elbow radiuses shall be 30 inches for primary conduits (greater than 600V) and 18 inches for secondary conduits (less than 600V). Increase radius, as required, based on pulling tension calculation requirements.
- D. Expansion Fittings at Finished Grade: Provide underground raceways with an expansion fitting after emerging from finished grade and exterior equipment pads. Field locate the expansion fitting above and within 24 inches of finished grade. Raceways extending less than 12 inches above finished grade, transitioning to LFMC within 12 inches of finished grade, and interior concrete building slabs do not require an expansion fitting unless required by code.
- E. Conduit Placement:
1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
  2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.
  3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum  $f'c = 2500$  and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.
  4. Before the Contractor pulls any cables into the conduit, Contractor shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
  5. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.
  6. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
  7. Ductbanks and conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
  8. All non-metallic conduit installed underground outside of a slab shall be rigid.
- F. Horizontal Directional Drilling:
1. Entire drill path shall be accurately surveyed, with entry and exit stakes placed and coordinated with other contractors. If using a magnetic guidance system, entire drill path shall be surveyed for any surface geo-magnetic variations or anomalies.

2. Any utility locates within 20 feet of the bore path shall have the exact location physically verified by hand digging or vacuum excavation. Restore inspection holes to original condition after verification.

G. Raceway Seal:

1. Where a raceway enters a building or structure, it shall be sealed with a sealing bushing or duct seal to prevent the entry of liquids or gases. Seal must be compatible with conductors and raceway system. Spare or unused raceway shall also be sealed.
2. All telecommunications conduits and innerducts, including those containing cables, shall be plugged at the building and vault with "JackMoon" or equivalent duct seal, capable of withstanding a 10-foot head of water (5 PSI).

### **3.08 COORDINATION OF BOX LOCATIONS**

- A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
- C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Recessed luminaires shall not be used as access to outlet, pull, and junction boxes. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Architect/Engineer and General Contractor.
- D. Locate and install to maintain headroom and to present a neat appearance.
- E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

### **3.09 OUTLET BOX INSTALLATION**

- A. Do not install boxes back-to-back in walls.
  1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
  2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- B. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

- C. The Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)
- D. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.
- E. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
- F. Provide knockout closures for unused openings.
- G. Support boxes independently of conduit.
- H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- I. Install boxes in walls without damaging wall insulation.
- J. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.
- K. Position outlets to locate luminaires as shown on reflected ceiling drawings.
- L. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- M. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- N. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

### **3.10 PULL AND JUNCTION BOX INSTALLATION**

- A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
- B. Support pull and junction boxes independent of conduit.
- C. Do not install boxes back-to-back in walls.
  - 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.

2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- D. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

### **3.11 EXPOSED BOX INSTALLATION**

- A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.
- B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.
- C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.
- D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.
- E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)
- F. Wood, plastic, or fiber plugs shall not be used for fastenings.
- G. Explosive devices shall not be used unless specifically allowed.

**END OF SECTION**



## **SECTION 26 0542 - EQUIPMENT WIRING SYSTEMS**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Electrical connections to equipment specified under other Sections or furnished by the Owner.

#### **1.02 REFERENCES**

- A. NEMA WD 1 - General Purpose Wiring Devices
- B. NEMA WD 6 - Wiring Device Configurations
- C. NFPA 70 - National Electrical Code (NEC)

### **PART 2 - PRODUCTS**

#### **2.01 CORDS AND CAPS**

- A. Straight-blade Attachment Plug: NEMA WD 1.
- B. Locking-blade Attachment Plug: NEMA WD 5.
- C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.
- D. Cord Construction: Oil-resistant thermoset insulated Type SO multi-conductor flexible cord with identified equipment grounding conductor, suitable for hard usage in damp locations.
- E. Cord Size: Suitable for connected load of equipment and rating of branch circuit over-current protection.

### **PART 3 - EXECUTION**

#### **3.01 INSPECTION**

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

#### **3.02 PREPARATION**

- A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

#### **3.03 INSTALLATION**

- A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.

- B. Make cord connections to equipment using flexible conduit. Use liquidtight flexible conduit in damp or wet locations.
- C. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.
- D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.
- E. Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.
- F. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated. Connect with conduit and wiring as indicated.
- G. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

**END OF SECTION**

## SECTION 26 0553 - ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Adhesive Markings and Field Labels
- B. Nameplates and Signs
- C. Product Colors

#### 1.02 REFERENCES

- A. NFPA 70E - National Electrical Safety Code
- B. NFPA 70 - National Electrical Code (NEC)
- C. ANSI A13.1 - Standard for Pipe Identification
- D. ANSI Z535.4 - Standard for Product Safety Signs and Labels

#### 1.03 QUALITY ASSURANCE

- A. Electrical identification products shall be suitable for the environment installed. Identification labels damaged by the environment due to ultraviolet light fading, damp or wet conditions, physical damage, corrosion, or other conditions shall be replaced with labels suitable for the environment.

### PART 2 - PRODUCTS

#### 2.01 ADHESIVE MARKINGS AND FIELD LABELS

- A. Adhesive Marking Labels for Raceway: Pre-printed, flexible, self-adhesive vinyl labels with legend indicating voltage and service (Emergency, Lighting, Power, HVAC, Communications, Control, Fire).
  - 1. Label Size as follows:
    - a. Raceways: Kroy or Brother labels 1-inch high by 12-inches long (minimum).
  - 2. Color: As specified for various systems.
- B. Colored Adhesive Marking Tape for banding Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.
- C. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: flexible acrylic bands sized to suit the cable diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.

- D. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.
- E. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from -40°F to 185°F (-40°C to 85°C), type 2/2S or type 21/21S based on application. Provide ties in specified colors when used for color coding. Cable ties shall be listed and identified for the application, securement, and support.
- F. Underground Plastic Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4 mil thick, printed legend indicating type of underground line, manufactured for direct burial service. Tape shall contain a continuous metallic wire to allow location with a metal detector.
- G. Aluminum, Wraparound Marker Bands: 1-inch width, 0.014 (5mm) inch thick aluminum bands with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- H. Brass or Aluminum Tags: 2" (50mm) by 2" (50mm) by .05-inch metal tags with stamped legend, punched for fastener.
- I. Indoor/Outdoor Number and Letters: Outdoor grade vinyl label with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.
- J. Text Sizes:
  - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
    - a. Font: Normal 721 Swiss Bold
    - b. Adhesive Labels: 3/16 inch minimum text height
    - c. Vinyl / Plastic Laminate Labels: 3/4" inch minimum text height

## **2.02 NAMEPLATES AND SIGNS**

- A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Labels shall be punched for mechanical fasteners.
- B. Text Sizes:
  - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
    - a. Text Height: 3/8 inch minimum
- C. Baked-Enamel Signs for interior Use: Preprinted aluminum signs, punched, or drilled for fasteners, with colors, legend, and size required for application. Mounting ¼" grommets in corners.

- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch galvanized-steel backing: and with colors, legend, and size required for application. Mounting 1/4" grommets in corners.
- E. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- F. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

**2.03 PRODUCT COLORS**

- A. Adhesive Markings and Field Labels:
  - 1. All Labels: Black letters on white face
  - 2. Normal Power and General Labels: Black letters on white face
  - 3. Control Labels: Black letters on white face
  - 4. Fire Alarm: Red letters on white face
  - 5. Emergency: Red letters on white face
- B. Nameplates and Signs:
  - 1. NORMAL POWER: Black letters on white face
  - 2. Control Labels: Black letters on white face
  - 3. EMERGENCY: White letters on red face
  - 4. GROUNDING: White letters on green face.
  - 5. CAUTION or UPS: Black letters on yellow face
- C. Raceways and Conduit:
  - 1. Provide color coded conduit as indicated below. Conduit shall be colored by the manufacturer:
    - a. Normal Power and General Distribution: Silver
    - b. Emergency Power Distribution System:
      - 1) Legally Required Standby: Yellow
      - 2) Optional Standby: Orange
    - c. Fire Alarm System: Red
    - d. Temperature Controls: Refer to mechanical cover sheet for color
    - e. Ground: Green
    - f. Low Voltage and Telephone: Purple
    - g. Clock, Sound, Security System, and Intercom: Black
- D. Box Covers:
  - 1. Box covers shall be painted to correspond with system type as follows:
    - a. Normal Power and General: Silver
    - b. Emergency Power and Distribution:
      - 1) Legally Required Standby: Yellow
      - 2) Optional Standby: Orange

- c. Fire Alarm System: Red
  - d. Temperature Controls: Refer to mechanical cover sheet for color
  - e. Ground: Green
  - f. Low Voltage and Telephone: Purple
  - g. Clock, Sound, Security System, and Intercom: Black
2. Box cover colors shall match conduit colors listed above.
- E. Conductor Color Identification: Refer to Part 3 for additional information.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as required by code.
- B. Exposed Ceilings and Finished Spaces: The project includes exposed ceilings in finished spaces. The installation of colored raceways and labeling may not be aesthetically desirable in finished spaces. The contractor shall coordinate identification requirements in exposed ceilings of finished spaces with the A/E prior to installation and ordering of materials.
- C. Electrical System Color Chart: This Contractor shall furnish and install framed 8" x 12" charts of the color-coded identification scheme used for the electrical system in all electrical rooms and next to the main fire alarm panel.
- D. Install identification devices in accordance with manufacturer's written instruction and requirements of Electrical Code.
- E. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.
- F. Circuit Identification: Tag or label conductors as follows:
  - 1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
  - 2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
  - 3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.
- G. Apply Danger, Warning, Caution and instruction signs as follows:

1. Install Danger, Warning, Caution or instruction signs where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
  2. 'Danger' indicates a hazardous situation which, if not avoided, will result in death or serious injury. ANSI standard red background, white letters.
  3. 'Warning' indicates a hazardous situation which, if not avoided, could result in death or serious injury. ANSI standard orange background, black letters.
  4. 'Caution' indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. ANSI standard yellow background, black letters.
  5. Emergency Operating Signs: Install, where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.
- H. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.
- I. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- J. Install ARC FLASH WARNING signs on all power distribution equipment per Section 26 0573.
- K. Selective Coordination Label: Install caution signs on all switchboards, distribution panels, panelboards, disconnects, and other equipment with selectively coordinated overcurrent protection devices. Sign at a minimum shall contain:
1. CAUTION: OVERCURRENT DEVICES IN THIS ENCLOSURE ARE SELECTIVELY COORDINATED. EQUIVALENT REPLACEMENTS AND TRIP SETTINGS ARE REQUIRED.
- L. Underground Electrical Lines: For exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 (150mm) to 8 (205mm) inches below grade. A single plastic line marker is permitted when the width of the common trench does not exceed 16 inches; provide a second plastic line marker to mark each edge of the trench when 16 inches of width is exceeded. Limit line markers to direct-buried cables.

### **3.02 FEEDER AND BRANCH CIRCUIT DIRECTORIES**

- A. Product:
1. Adhesive labels and field markings
  2. Nameplates and signs

- B. Feeder Directories Branch: Provide each feeder, branch circuit, feeder modification, and branch circuit modification with a typed circuit directory label. Refer to technical equipment specification sections for additional requirements. Include the following with each label:
  - 1. Load Description: Lighting, receptacles, specific equipment, spare, space, or similar description.
  - 2. Location: Room name, number, location.
- C. Provide a factory or custom clear plastic sleeve for each branch panel directory and secure to inside panel cover.

### **3.03 LIGHTING CONTROL AND RECEPTACLE COVER PLATES**

- A. Product:
  - 1. Adhesive labels and field markings
  - 2. Nameplates and signs
- B. Identification material to be a clear, 3/8-inch Kroy tape or Brother self-laminating vinyl label with black letters. Embossed Dymo-Tape labels are not acceptable. Permanently affix identification label to cover plates, centered above the receptacle openings.

### **3.04 CONDUIT AND EXPOSED CABLE LABELING**

- A. Product:
  - 1. Adhesive labels and field markings
- B. Conduit Identification: Pre-printed, flexible, self-adhesive vinyl labels with legend at 102025 foot (7.5 meter) intervals to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible, or separated by enclosures, walls, partitions, ceilings, and floors. Labels for multiple conduits shall be aligned. Refer to color requirements in Part 2 when applicable in addition to the following:
  - 1. 1000 Volt or less Normal/Emergency Power: Indicate feeder identification and voltage.
  - 2. Essential Electrical System EES: When applicable the label shall include "Essential Electrical System EES". Maximum interval between label intervals shall be 25 feet or as required by code.
  - 3. Fire Alarm: Indicate "FIRE ALARM".
  - 4. Grounding: Indicate "GROUND" and equipment and designation.
  - 5. Security System: Indicate "Security".
  - 6. Telephone System: Indicate "Telephone".
- C. Blank conduit ends or outlet boxes for future extension of system shall have permanent identification marker indicating purpose of conduit or box and where the raceway originated.

### **3.05 CONDUIT AND RACEWAY COLOR BANDING FOR EXISTING CONDITIONS AND REMODELING**

- A. New Conduit and Raceways: Identify new conduits and raceways with color banding. The following products and materials shall be identified with color banding when required by Part 1 of this specification.



1. Rigid metallic conduit and fittings (RMC)
2. Intermediate metallic conduit and fittings (IMC)
3. Reinforced thermosetting resin conduit (RTRC)
4. Phenolic reinforced thermosetting resin conduit (phenolic RTRC conduit) Example:  
Fire-rated cable and assemblies
5. Wire and cable installed with or without raceways:
  - a. Fire-rated cable and assemblies (including but not limited to MI, fire-rated MC)
  - b. Metal-clad cable (MC)
  - c. Low voltage cabling

B. Instructions:

1. Band exposed or accessible raceways, cables, and bare conductors of the. Bands shall be pretensioned, snap-around colored plastic sleeves, colored adhesive marking tape, or a combination of the two. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side. Refer to Part 1 of this specification for specific systems and colors requiring banding.
2. Install bands at changes within 36 inches of direction changes, all wall/floor penetrations, at each junction box, and at 10-foot maximum intervals in straight runs.

### 3.06 BOX LABELING

A. Products:

1. Adhesive labels and field markings

B. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch Kroy tape OR Brother self-laminating vinyl label, letters/numbers color coded same as conduits. In rooms that are painted out, provide labeling on inside of cover.

C. All junction, pull, and connection boxes shall be identified as follows:

1. For power and lighting circuits, indicate system voltage and identity of contained circuits ("120V, 1LA1-3,5,7").
2. Essential Electrical System EES: When applicable the label shall include "Essential Electrical System EES". Maximum interval between label intervals shall be 25 feet or as required by code.
3. For other wiring, indicate system type and description of wiring ("FIRE ALARM NAC #1").

### 3.07 CONDUCTOR COLOR CODING

A. Products:

1. All wire and cables shall be color coded by the manufacturer.
2. All wires and cables, 6 AWG or larger, used in motor circuits, main feeders, sub-main feeders, and branch circuits shall be coded by the application of plastic tape. The tape shall be 3-M, Plymouth or Permacel in colors specified below. The tape shall be applied at each conductor termination with two 1-inch tape bands at 6-inch centers. Contractor option to use colored cabling in lieu of the tape at each end for conductor 6 AWG to 500 KCM.

- B. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, vaults, manholes etc., where the wires and cables are visible and terminations are made. The same color coding shall be used throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.
- C. Colored cable ties shall be applied in groups of three ties of specified color to each conductor at each terminal or splice point starting 3 inches from the termination and spaced at 3- inches centers. Tighten to a snug fit, and cut off excess length.
- D. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.
- E. Conductors shall be color coded as follows:
  - 1. 208Y/120 Volt, 4-Wire:
    - a. A-Phase - Black
    - b. B-Phase - Red
    - c. C-Phase - Blue
    - d. Neutral - White
    - e. Ground Bond - Green
  - 2. Grounding Conductors:
    - a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.
    - b. Isolated Equipment Ground Conductors: Green with colored distinctive yellow stripe along the entire length of the conductor. Isolated ground for feeders, use colored tape with alternating bands of green and yellow to provide a minimum of three bands of green and two bands of yellow.
  - 3. Cabling for Remote Control, Signal, and Power Limited Circuits:
    - a. Fire Alarm: Red.
    - b. Low Voltage Switching: Per manufacturer recommendations and code requirements.
    - c. Building Automation Systems and Control: Refer to the Temperature Control Contactor notes located on the mechanical cover sheet.
    - d. Electronic Control: Per manufacturer recommendations and code requirements.

### **3.08 EQUIPMENT CONNECTION IDENTIFICATION**

- A. Products:
  - 1. Nameplates and signs
- B. Provide identification for hard wired electrical connections to equipment such as disconnects switches, starters, etc. Plug and cord type connections do not require this specific label.

### **3.09 POWER DISTRIBUTION EQUIPMENT IDENTIFICATION**

- A. Products:

1. Nameplates and signs
- B. Provide identification on the front of all power distribution equipment such as panelboards, switchboards, switchgear, motor control centers, generators, UPS, storage battery disconnects, transfer switches, etc. Labels shall be visible on the exterior of the gear, correspond to the one-line diagram nomenclature, and identify each cubicle of multi-section gear.
1. Interior Equipment: The identification material shall be engraved plastic-laminated labels.
  2. Exterior Equipment: The identification material shall be engraved vinyl labels.
  3. Labeling shall include:
    - a. Equipment type and contract documents designation of equipment.
    - b. Voltage of the equipment.
    - c. Name of the upstream equipment and location of the upstream equipment if it is not located within sight.
- C. Service Equipment Label: A separate nameplate for the service entrance equipment and include:
1. Nominal system voltage, service wire size, quantity, material, distance
  2. Maximum available fault current; refer to one-line diagram for values
  3. Clearing time of overcurrent protection devices based on available fault current. Refer to calculations and report from Section 26 0573 for value.
  4. Date of fault current study; refer to one-line diagram
  5. Date of label
  6. Sample Label:  
  
480Y/277V, 6 SETS 4#750KCM CU, 75FT  
39,800 AMPS AVAILABLE FAULT CURRENT  
0.07 SECOND CLEARING TIME  
DATE OF STUDY: 1 JAN 2017  
DATE OF LABEL: 4 JUL 2017
- D. Arc Energy Reduction Label:
1. Provide a separate engraved plastic laminate label centered at the top of each vertical section of the electrical gear indicating the following when applicable.
    - a. Label: "This equipment is designed with a system listed below".
    - b. Applicable Systems:
      - 1) Zone-selective interlocking system for selective coordination and arc energy reduction
      - 2) Differential relaying system for selective coordination and arc energy reduction
      - 3) Arc energy reducing maintenance switch
      - 4) Energy reducing active arc flash mitigation system
- E. Adjustable-Trip Over Current Protection Label:
1. Provide a separate engraved plastic laminate label adjacent to each overcurrent projection device with adjustable trip settings. Provide label separate from load identification label.

- a. Label:
  - 1) Long-time delay:
  - 2) Long-time pickup:
  - 3) Short-time delay:
  - 4) Short-time pickup:
  - 5) Instantaneous:
  - 6) Ground fault delay:
  - 7) Ground fault:

- b. Sample Label:
  - Long-time delay: 10.0
  - Long-time pickup: 1.0
  - Short-time delay: 0.15
  - Short-time pickup: 5.0
  - Instantaneous: 2.0
  - Ground fault delay: 0.25
  - Ground fault: 50.0

F. Branch panelboards shall be provided with typed panel schedules upon completion of the project. A copy of all panel schedules for the project shall be turned over as part of the O&M Manuals. Refer to Section 26 0500 for other requirements.

### 3.10 SERIES RATING IDENTIFICATION

- A. Products:
  - 1. Nameplates and signs
- B. Upstream devices of series rated components not enclosed in a single NEMA type enclosure shall be identified with a nameplate reading "CAUTION - SERIES RATED SYSTEM - IDENTICAL COMPONENT REPLACEMENT REQUIRED".
- C. Downstream devices of series rated components not enclosed in a single NEMA type enclosure shall be identified with a nameplate reading "CAUTION - SERIES RATED SYSTEM - ADDITIONAL SERIES COMBINATION RATING: XX,XXX RMS SYMMETRICAL AMPERES" where XX,XXX shall be the series combination rating.

### 3.11 POLE IDENTIFICATION

- A. Product:
  - 1. Adhesive labels and field markings
  - 2. Nameplates and signs
- B. Lighting poles, bollards and overhead distribution poles shall be individually identified with a unique number, for maintenance purposes. Apply the vinyl label number above the hand hole cover or 24" (610mm) above grade. Bollards may be identified with a number applied inside the luminaire that is visible from the exterior.

**END OF SECTION**



## **SECTION 26 0573 - POWER SYSTEM STUDY**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. low voltage distribution system power study.
- B. Short-circuit analysis and report.
- C. Selective coordination analysis and report.
- D. Arc-flash hazard analysis and report.

#### **1.02 RELATED SECTIONS**

- A. Section 26 0500 - Basic Electrical Requirements
- B. Section 26 2300 - Low Voltage Switchgear
- C. Section 26 2413 - Switchboards
- D. Section 26 2414 - Paralleling and Distribution Switchgear (600 Volt)
- E. Section 26 2416 - Panelboards
- F. Section 26 3213 - Packaged Engine Generator Systems
- G. Section 26 3600 - Transfer Switch

#### **1.03 QUALITY ASSURANCE**

- A. Analyses shall be performed by an agent authorized by the manufacturer of equipment specified in the related specification sections.

#### **1.04 SUBMITTALS**

- A. Documentation shall bear the seal/signature of the licensed Professional Engineer who performed the analysis.
- B. The input for the power system study shall be based on the contract documents, with estimated conductor lengths and field investigation of existing equipment types, sizes, ratings provided by the Electrical Contractor. IMEG will provide a preliminary Power Tools for Windows project file for information, if requested.
- C. Documentation of the analyses shall be submitted in a single bound electronic (PDF or equal) format and shall accompany the shop drawing submittals for equipment provided under the related work specification sections. The submittal of these related specification sections will not be reviewed without this documentation. Submit a sample arc-flash hazard label for Owner review and approval prior to printing.

- D. Power system study project model shall be submitted on electronic media for review and the Owner's operating and maintenance records.

#### **1.05 REFERENCES**

- A. NFPA 70 - National Electrical Code (NEC)
- B. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations, latest version
- C. ANSI Z535.4 - Products Safety Signs and Labels

#### **1.06 SCOPE**

- A. Provide a power system study of the electrical system shown on the plans. The study shall include arc-fault analysis, selective coordination analysis and arc flash hazard analysis.
- B. Contractor is required to provide a fully coordinated system for the normal and emergency electrical system or emergency electrical system and the associated normal side of each transfer switch and all other locations indicated on the one line diagram. Contractor shall provide overcurrent protective devices with the appropriate models, frame sizes, trip units, etc. as required to provide a selectively coordinated system.

### **PART 2 - PRODUCTS**

#### **2.01 POWER SYSTEM STUDY**

- A. Power systems study shall be completed in Power Tools for Windows (PTW) version 10 or later version or pre-approved equivalent program.
- B. Power system studies including, but not limited to short-circuit analysis, selective coordination, and arc-flash analysis are inherently iterative in nature. The initial and subsequent analysis commonly requires engineering evaluation, equipment modification, setting adjustments, and revised analysis report. The power system analysis scope shall not be considered complete until all outstanding engineering, equipment and device setting solutions have been resolved and documented by a final report. The power system study vendor shall provide inclusive bid provisions for the initial, subsequent, final analysis and associated reports.

### **PART 3 - EXECUTION**

#### **3.01 SHORT-CIRCUIT ANALYSIS**

- A. Provide a complete short-circuit analysis from the utility service to and including the entire building distribution as shown on the drawings.
- B. Analysis shall include the entire distribution system from the point of connection to the utility power source to the distribution panels and branch circuit panelboards.
- C. Short-circuit analysis documentation shall be made in one-line diagram form showing the magnitude and location of each calculated fault. Fault current calculations shall be made at the main bus of each switchboard, distribution panel, and branch circuit panel. A summary of the fault currents available shall also be submitted and made available to the AHJ if requested.

### 3.02 SELECTIVE COORDINATION ANALYSIS

- A. Provide a complete selective coordination analysis, comparing time/current curves of the protective devices to be installed to assure complete selectivity between main and downstream devices for code-required branches and branches identified on one-line drawings. Overcurrent protective devices serving the essential electrical system shall selectively coordinate for the period of time that a fault's duration extends beyond 0.01 second. Overcurrent protective devices serving the normal shall selectively coordinate for the period of time that a fault's duration extends beyond 0.01 second.
- B. Provide trip settings for all (selectively coordinated and non-selectively coordinated) adjustable trip over current protection devices including long time delay, long time pickup, short time delay, short time pickup, instantaneous and ground fault. Selectively coordinated branches shall be based on the selective coordination study results. Non-selective coordinated branches shall be based on the design trip ratings. Provide selective coordination between all ground fault trip settings.
- C. The analysis shall include primary protective device, secondary main switchboard/switchgear device(s), switchboard/switchgear branch feeder devices, generator breaker, distribution panel, panelboard main devices, and branch feeder devices.
- D. The analysis shall include all normal, legally required, and optional standby overcurrent protection devices served by the same electrical bus and directly in parallel with the emergency branch requiring selective coordination.
- E. The coordination plots provided shall indicate graphically the coordination proposed for the system on full-size log forms and shall define the types of protective devices selected, together with proposed time dial and pickup settings required. The plots shall include titles, representative one-line diagrams, legend, complete parameters for transformer(s), and complete operating bands for circuit breaker trip devices, fuses, etc.
  - 1. The long-time region of the coordination plots shall designate the pickups required for the circuit breakers.
  - 2. The short-time region shall indicate the magnetizing in-rush and ASA-withstand-transformer parameter, the circuit breaker, short-time and instantaneous trip devices, fuse-manufacturing tolerance bands, significant symmetrical fault currents, etc.
  - 3. Molded case circuit breakers shall be separated from each other and the associated primary protective device by a 16% current margin for coordination and protection in the event of secondary line-to-line faults.
  - 4. The protective device characteristics or operating bands shall be suitably indicated to reflect the actual symmetrical fault currents sensed by the device.
  - 5. The drawings and specifications indicate the general requirements for motors, motor-starting equipment, and medium-voltage and low-voltage equipment, but additional specific requirements of equipment furnished shall be determined in accordance with the results of the coordination study.
    - a. The study shall include verification of equipment ratings and settings. The Contractor shall keep the study up-to-date with any project changes which affect the study and submit the revised study for review. A final electronic copy shall be submitted with the record drawings.



- F. Provide summary table of adjustable overcurrent protective devices settings for the operating and maintenance manual.

### **3.03 ADJUSTMENTS**

- A. Manufacturer's authorized representative or Contractor shall set all adjustable protective devices to values indicated in the approved coordination study. Apply settings prior to placing equipment into operation. When the scope of work or execution includes remodel or phases construction, the contractor shall adjust applicable settings as required prior to each system component placed in operation.
- B. Wherever the arc flash incident energy exceeds Arc Flash Category 2 (i.e. greater than 8 cal/cm<sup>2</sup>), provide options for adjusting breaker trip times, if possible, to reduce energies to Category 2 or below.

**END OF SECTION**

## SECTION 26 0933 - LIGHTING CONTROL SYSTEMS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Line and low voltage standalone lighting controls
- B. Distributed lighting control

#### 1.02 RELATED SECTIONS

- A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:

1. 26 51 19 LED Lighting
2. Electrical Drawings: Plans, luminaire schedules, diagrams, and details.

#### 1.03 RELATED WORK

- A. Section 01 9100 - Commissioning
- B. Section 23 0900 - Facility Management Control System (FMCS)
- C. Section 26 5100 - Lighting

#### 1.04 QUALITY ASSURANCE

- A. Manufacturers shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. All components and assemblies are to be factory pre-tested prior to delivery and installation.
- C. Comply with Electrical Code as applicable to electrical wiring work.
- D. Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
- E. Panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Panels and accessories used for control of life safety and critical branch circuits shall be listed under UL 924 Emergency Lighting and Power Equipment.
- F. All assemblies are to be in compliance with FCC emissions standards specified in Part 15 Subpart J for Class A applications.

### **1.05 REFERENCES**

- A. FCC Rules and Regulations, Part 15, Subpart J - Radio Frequency Interference
- B. FS W S 896 Switch, Toggle
- C. NEMA WD 1 - General Color Requirements for Wiring Devices
- D. NEMA WD 7 - Occupancy Motion Sensors
- E. NFPA 70 - National Electrical Code (NEC)
- F. UL Standard 916 Energy Management Equipment
- G. UL 924 - Emergency Lighting and Power Equipment
- H. UL 1472 - Solid-State Dimming Controls

### **1.06 SUBMITTALS**

- A. Submit product data under provisions of Section 26 0500.
- B. Submit a comprehensive package including devices, hardware, software, product specification, finishes, dimensions, installation instructions, warranty, system software requirements, and roles and responsibilities of all persons and groups involved in installation, execution, and commissioning.
- C. Provide floor plan showing location, orientation, and coverage area of each control device, sensor, and controller/interface. For areas requiring multiple sensor devices for appropriate coverage, submit specific manufacturer-approved sensor layout as an overlay directly on the project drawings, either in print or approved electronic form.
- D. Submit a list of devices and equipment that will be installed for each sequence of operation.
- E. Submit project specific control wiring diagrams showing all equipment, line voltage, and control wiring requirements for all components including, but not limited to, dimmers, relays, low voltage switches, occupancy sensors, control stations, dimmer panels, relay panels, and communication interfaces and programming instructions for each sequence of operation. Include network cable specification and end-of-line termination details, if required.

### **1.07 EXTRA STOCK**

- A. Provide extra stock under provisions of Section 26 0500.
- B. Sensors, Controls, Power Supplies, and Relays: Five (5) percent of quantity installed. Minimum of two (2) of each configuration and type.
- C. Relays and Dimmer Modules: Five (5) percent of quantity installed. Minimum of two (2) of each size and type.
- D. Control Stations: One (1) of each configuration and type, except for LCD touch screens requiring factory setup prior to installation.

## **1.08 PROJECT RECORD DOCUMENTS**

- A. Submit project record documents under provisions of Section 26 0500.
- B. Accurately record location of all controls and devices. Include description of switching sequences and circuiting arrangements.

## **1.09 OPERATION AND MAINTENANCE DATA**

- A. Submit emergency, operation, and maintenance data under provisions of Section 26 0500. Data shall also include the following:
  - 1. Schedule for routine maintenance, inspection, and calibration of all lighting control devices and system components. Recommended schedule for inspection and recalibration of sensors.
  - 2. Complete narrative describing intended operation and sequence for each control scenario and system component, updated to reflect all changes resulting from commissioning of systems. Narrative shall indicate recommended settings for devices where applicable.
  - 3. Replacement part numbers for all system components.
- B. Identify installed location and labeling for each luminaire controlled by automated lighting controls.
- C. Submit software operating and maintenance manuals, program software backup on compact disc or compatible media with data files, device address list, and a printout of software application and graphic screens, where applicable.

## **1.10 SYSTEM DESCRIPTION**

- A. Performance Statement: This specification section and the accompanying lighting design documents describe the minimum material quality, required features, and operational requirements of the lighting control system (LCS). These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the performance required of the system, as presented in these documents, the Contractor and system manufacturer/vendor are solely responsible for determining all equipment, wiring, and programming required for a complete and operational system.
- B. Provide an integrated lighting controls system consisting of panels, power supplies, controllers, sensors, relays, switches, devices, wiring, etc. necessary to perform the Lighting Control Sequence of Operation as defined on the plans and specifications. Contractor is responsible for confirming that all components and luminaires interoperate as a single system.
  - 1. Lighting control schedules: Describes the required operation and performance for lighting control in each space. Lighting control schedules are indicated on the drawings.
  - 2. Drawings: The drawings include lighting control schedules, locations of control interface devices, sensors, and control zones. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted with the shop drawings.
- C. The following control types and features are acceptable. Acceptable control locations are shown on the drawings.

1. Distributed Control: Control equipment is in the space/zone being controlled; not reliant on centralized controllers.
  - a. All locations shall have the ability to be networked for remote control and monitoring, but network connections are not required.
2. Centralized Control: Control equipment is in a central location serving multiple spaces/zones and provides time-based schedule and remote control.
3. Wireless Control: Equipment that uses radio frequency to transmit lighting control signals.

#### **1.11 MOCKUP**

- A. Provide and install luminaires with power and control connections in mockup rooms as identified in Division 1. Approved luminaires and controls in mockup may be reused as part of complete work if in original condition.

#### **1.12 COMMISSIONING**

- A. Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Agent. Project closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Division 1 for detailed commissioning requirements.
- B. The system shall be functionally tested by a factory-authorized engineer and comply with the Sequence of Operation. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system.

#### **1.13 WARRANTY**

- A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two (2) years from date of commissioning.
- B. Occupancy, vacancy, daylight sensors and controls shall have a five (5) year warranty from date of Substantial Completion.

### **PART 2 - PRODUCTS**

#### **2.01 LIGHTING CONTROLS**

- A. All items of material having a similar function (e.g., switches, dimmers, sensors, contactors, relays, etc.) shall be of the same manufacturer, unless specifically stated otherwise on drawings or elsewhere in the specifications. Lighting control switches, systems, and components shall be listed.
- B. Color of lighting controls and sensors shall match the receptacle wiring devices specified in the space.
- C. The functions described in the lighting sequence of operation shall dictate the actual lighting control device required to accomplish the functions described for the space.

## **2.02 LIGHTING CONTROL STATION**

- A. SW; The lighting control station shall contain the controls required by the lighting sequence of operation in a common coverplate. The controls may consist of switches, dimmers, occupancy sensors, pushbuttons, etc.
  - 1. In spaces where the wall control station is shown in multiple locations, the sequence of operation shall be the same at all locations, unless noted otherwise.
  - 2. The controls supplier shall prepare control station shop drawings showing arrangement of controls, dimensioned elevations, wiring diagram, and recommended backboxes. The shop drawing submittal should be identified with the lighting sequence that the station provides. Submit data sheets on the switches, dimmers, sensors, buttons, etc. contained in the control station.

## **2.03 DEVICE COLOR**

- A. All switch, lighting controls, and coverplate colors shall be the same as wiring devices, unless indicated otherwise.

## **2.04 COVERPLATES**

- A. All switches and lighting controls shall be complete with coverplates that match material and color of the wiring device coverplates in the space.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
- C. Install nameplate identification as indicated in Section 26 0553.
- D. Plate-securing screws shall be metal with head color matching the wall plate finish.

## **2.05 WALL SWITCHES**

- A. Refer to Electrical Symbols List for device type.
- B. SW-1P; Single Pole Switch:
  - 1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired.
  - 2. Manufacturers:
    - a. Hubbell HBL1221
    - b. Leviton 1221-2
    - c. Pass & Seymour PS20AC1
    - d. Cooper AH1221
- C. SW-1P-EM; Emergency Single Pole Switch:
  - 1. Single throw, 120/277-volt, 20-amp maintained contact. Red handle, side and back wired. Switch shall have with illuminated handle that is illuminated when load is off.
  - 2. Manufacturers:
    - a. HBL1221R

- b. Leviton 1221-2R
  - c. Pass & Seymour PS20AC1-RED
  - d. Cooper AH1221RD
- 3. Manufacturers:
  - a. Pass & Seymour 2625RED.
- D. SW-3W; Three-way Switch:
  - 1. 120/277 volt, 20 amp. Toggle handle, side and back wired.
  - 2. Manufacturers:
    - a. Hubbell 1223
    - b. Leviton 1223-2
    - c. Pass & Seymour PS20AC3
    - d. Cooper AH1223
- E. SW-3W-EM; Emergency Three-way Switch:
  - 1. 120/277 volt, 20 amp. Red toggle handle, side and back wired.
  - 2. Manufacturers:
    - a. Hubbell 1223R
    - b. Leviton 1223-2R
    - c. Pass & Seymour PS20AC3-RED
    - d. Cooper AH1223RD
- F. SW-4W; Four-way Switch:
  - 1. 120/277 volt, 20 amp. Toggle handle, side and back wired.
  - 2. Manufacturers:
    - a. Hubbell 1224
    - b. Leviton 1224-2
    - c. Pass & Seymour PS20AC4
    - d. Cooper AH1224
- G. SW-4W-EM; Emergency Four-way Switch:
  - 1. 120/277 volt, 20 amp. Red toggle handle, side and back wired.
  - 2. Manufacturers:
    - a. Hubbell HBL1224R
    - b. Leviton 1224-2R
    - c. Pass & Seymour PS20AC4-RED
    - d. Cooper AH1224RD

## 2.06 WALL DIMMERS

- A. UL listed with integral air-gap switch for on/off control.
- B. Integral EMI/RFI suppression.

- C. Non-viewable heat sink.
- D. Dimmer compatibility and wiring with the load being controlled shall be verified by Contractor prior to purchase and installation.
- E. Dimmer to match device color.
- F. SW-D-15; 1500-Watt Single Pole Incandescent Dimmer:
  - 1. 120-volt, linear slider operator with positive off. Mount in double gang box.
  - 2. Manufacturers:
    - a. Lutron N-1500
    - b. Lightolier MP1500
    - c. Pass & Seymour CD1600
- G. SW-OD; Wall 0-10V Dimmer / Occupancy sensor:
  - 1. Wall switch with manual on/auto off. 120VAC load rating of 0-800 W for electronic ballast, LED. 277VAC load rating of 0-1,800 W for electronic ballast, LED. adjustable OFF delay. 0-10V dimming with up to 30ma sink. Automatic ON/OFF, manual ON/automatic OFF, or occupancy on to predetermined dimming level go to last dimming setting upon occupancy.
  - 2. Manufacturers:
    - a. Sensor Switch WSX D Series

## 2.07 LOCAL DAYLIGHTING CONTROLS

- A. Standalone Interior Photo Sensors:
  - 1. SW-LS; Daylight Level Sensor - On/Off Control - One Zone:
    - a. On/Off control. Range of 10-200 FC. Adjustable deadband prevents cycling. Adjustable time delay. 120/277 volt.
    - b. Manufacturers:
      - 1) Watt Stopper LS-102
      - 2) Sensor Switch CM-PC
      - 3) Hubbell Automation DLCPD Series
      - 4) Greengate PPS-4
  - 2. SW-LS-3Z; Daylight Level Sensor and Controller - On/Off Control - Three Zones:
    - a. On/off control of up to three 10-amp zones. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. 120/277 volt.
    - b. Manufacturers:
      - 1) Watt Stopper LCO-203/LS-290C
      - 2) Hubbell Automation LUXSTATOCM/LUXSTATLS
      - 3) LC&D Micro GR/2404 iDH/Pcell
      - 4) Sensor Switch N-CMPC



3. SW-LS-D: Daylight Level Sensor and Controller - 0-10V Dimming - One Zone:
  - a. Dimming control of one 0-10V zone. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. Coordinated with dimming ballast prior to submittal.
  - b. Manufacturers:
    - 1) Watt Stopper LS-301
    - 2) Hubble Automation DLC7
    - 3) Sensor Switch N-CMADC
  
4. SW-LS-D-3Z; Daylight Level Sensor and Controller - Dimming - Three Zones:
  - a. Dimming control of up to three zones of 0-10V. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. Coordinate with dimming ballasts prior to submittal.
  - b. Manufacturers:
    - 1) Watt Stopper LCD-203/LS-290C
    - 2) Hubbell Automation LUXSTATDCM/LUXSTATLS
    - 3) LC&D Micro GR/2404 IDIM/Pcell
    - 4) Sensor Switch N-CMADC.
  
5. SW-LS-M; Daylight Level Sensor and Controller - Multilevel/Bi-level On/Off Control - Dual Zones:
  - a. Multilevel/bi-level on/off control of up to two 10-amp zones. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. 120/277 volt.
  - b. Manufacturers:
    - 1) Watt Stopper LCO-203/LS-290C
    - 2) Hubbell Automation DLCPCC/DLCPCI
    - 3) Sensor Switch CM-PC-DZ
  
6. Sensor shall detect changes in ambient light level and provide triggering of lighting groups in area based on sequence of operation.
7. Sensor shall be configurable via DIP switches at device or via handheld wireless remote programming unit. Settings shall include:
  - a. Ambient sensitivity range between 1 and 1,000 foot-candles.
  - b. Time delay of 5 to 300 seconds.
  - c. Trigger setpoints with deadband adjustment.
  
8. Sensor shall provide on/off setpoints in quantity as specified on drawings and as shown in the sequence of operation.
9. Sensor shall be ceiling- or wall-mounted for range and viewing angle meeting application requirements as outlined in the sequence of operation.
10. Output signal from sensor shall be linear with light level.

B. SW-LS-PC; Standalone Exterior Photo Sensors:

1. Sensor shall be within a weatherproof enclosure, with design operation in temperatures of -30°F to +130°F. Sensor shall have threaded stem for box mounting, with knuckle to permit aiming of receptor after installation. Sensor shall be mounted facing north.
2. Sensor shall contain an integral switching contactor rated for 277-volt operation, with loads of up to 1,800 VA. Contacts shall be configured for zero-crossing closure to provide 100,000 cycle minimum operation.
3. Sensor shall detect changes in daylight levels to provide triggering of exterior lighting equipment based on the sequence of operation.
4. Sensor shall be field configurable at the device or via handheld wireless remote controller. Configurable settings shall include:
  - a. Ambient sensitivity range of 5 to 1,500 foot-candles.
  - b. Adjustable setpoint.
  - c. Deadband adjustment by percentage of setpoint.
  - d. Time delay of up to five minutes.
5. Sensor shall be equipped with a lens cover that can be applied for system testing during daylight conditions.
6. Manufacturers:
  - a. Paragon
  - b. Tork
  - c. Intermatic

## **2.08 INDOOR OCCUPANCY AND VACANCY SENSORS**

- A. General Description: Wall- or ceiling-mounting, solid-state units with a separate power supply/relay unit.
  1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied, with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes. Vacancy sensors require a manual switch operation to turn lights on and off, with a time delay for turning lights off when unoccupied.
  2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
  3. Relay Unit: Dry contacts rated for 20 A ballast load at 120 and 277 VAC, for 13-amp tungsten at 120 VAC, and for 1 hp at 120 VAC. Power supply to sensor shall be 24 V dc, 150-mA, Class 2 power source as defined by Electrical Code.
  4. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure. Mount relay above accessible ceiling near entry door to room or area.
    - c. Time Delay and Sensitivity Adjustments: Recessed and concealed.
  5. Indicator: LED to show when motion is being detected during testing and normal operation of the sensor.
  6. Bypass Switch: Override the on function in case of sensor failure.
  7. Power Supply and Child Packs: Provide as required for sensor quantity and switching scheme. Mount to standard 1/2" knockout on electrical box above accessible ceiling near entry door to room or area. Sensor power shall be from emergency circuit if emergency lighting is in the area.

8. Detection Coverage (Room): Detect occupancy anywhere in an area based on hand motion.
  9. Detection Coverage (Corridor): Detect occupancy based on a half-step motion.
  10. Warranty: Five (5) year warranty.
- B. Dual-Technology Type: Detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
1. SW-VS-D or SW-OC-D; 360 Degree Coverage Pattern:
    - a. Frequency greater than 40 KHz. Dual sensing verifications (requires both technologies to activate), either technology maintains on status. Integrated ambient light level sensor (2 to 200 FC range), adjustable sensitivity and time delay. Sensor shall control all circuits in area, unless noted otherwise. Initial settings: ambient sensor 40 FC.
    - b. Manufacturers:
      - 1) Watt Stopper DT 300 Series
      - 2) Hubbell OMNI-DT2000 or ATD2000C
      - 3) Greengate OAC-DT
      - 4) Leviton OSC##-MOW
      - 5) Sensor Switch CM PDT 10
  2. SW-O; Wall Switch:
    - a. Wall switch with manual on/auto off. 120/277 VAC load rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of minor motion in 12' x 15' pattern.
    - b. Manufacturers:
      - 1) Watt Stopper DW-100 Series
      - 2) Hubbell LHMTS, Leviton OSSMT series
      - 3) Sensor Switch WSX-PDT SA Series
- C. Mask sensors where necessary to prevent nuisance switching from adjacent areas.
- D. PIR Type: Detect occupancy by sensing a combination of heat and movement in area of coverage.
1. SW-O; Wall Switch Occupancy Sensor:
    - a. Passive infrared, zero crossing circuitry, adjustable sensitivity and time delay, no minimum load requirements, manual or auto on operation, Initial settings: 10 minutes, ambient sensor 40 FC. Manual ON for vacancy sensing.
    - b. Manufacturers:
      - 1) Watt Stopper PW-100 Series
      - 2) Sensor Switch WSX
      - 3) Hubbell LHIRS1 or AP1277
      - 4) Leviton ODS15
      - 5) Greengate OSW-P-0451

## 2.09 DISTRIBUTED LIGHTING CONTROL

- A. Manufacturers: as listed below meet the qualifications as outlined in this specification. Contractor is responsible for verifying that selected manufacturer is capable of furnishing the complete system as specified herein.
1. Acuity Controls nLight Series
  2. Legrand Watt Stopper DLM Series
  3. Hubbell Automation NX Series
  4. Eaton Greengate RC3 Series (room-based system)
  5. Osram Encelium Series
  6. Lutron
- B. System Description: The lighting control system shall be a network of remote modules connected to a digital network via network hubs and controlled through a system server / central station. Lighting control devices connect to the modules and communicate via the digital network with the system server. System includes all associated wiring, relay modules, photocells, switches, dimmers, time clock, occupancy sensors, network interfaces, and hubs. System shall utilize distributed relays modules, allowing these relay modules to be located above accessible ceilings in or adjacent to rooms they are controlling.
- C. Control Devices: All occupancy sensors (ultrasonic, IR and dual technology type), photocells, switches, and timers shall be provided with system and designed to operate on system network. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission.
- D. Relay Modules: Mounted in NEMA enclosure with physically separate 120/277-volt wiring compartment from low voltage control wiring. Provide low voltage digital communication to control devices as shown on drawings and schedules. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission. Dimmable relay modules shall be provided where indicated. Relay modules shall contain up to four (4) relays. Relay modules shall be labeled with room number that relays control lighting within.
- E. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type, rated 20 A, 125-volt AC for tungsten filaments and 20 A, 277-volt AC for electronic ballasts, 50,000 cycles at rated capacity.
- F. System shall include server / central station with operating software, data network, and BACnet IP communication with other systems as described. System communication protocol shall be compatible with the building automation system.
- G. System server / central station shall provide programmable operation of lights connected via system relays and controlled with system devices. System software shall provide control of relays and control devices, time and sequence scheduling, timed out and blink light operation, and monitoring and reporting of system events and components. Initial programming shall be as shown on plans and schedules.
- H. Server / Central Control Station: Lighting control system manufacturer shall be responsible to assure coordination between relay modules, network hubs, and control system server/ central station such that system performs as described. Server shall be provided with monitor, keyboard, and mouse, and plugged into a receptacle connected to an equipment emergency circuit as a minimum.

- I. Network Hub: Network Hub shall contain processor and astronomic time clock for control and monitoring of lighting. Network hub shall be fed from an equipment emergency circuit at a minimum.

## **2.10 CENTRAL LIGHTING CONTROL - RELAY PANEL TYPE (NETWORK)**

### **A. Central Lighting Control Features and Functions:**

1. Dimming system presets shall be programmable via preset/fader station directly at the control panel, or via network-based workstation software. Dimming presets shall have discrete fade times with 0.1 second resolution, programmable from zero to 24 hours, and shall be selectable via button, fader, clock event, macro or network interface.
2. Clock events shall be activated by calendar schedule, by day type and/or specific day programming, including every day, weekday, weekend, S, M, T, W, H, F, S, Holiday. Clock events shall also be activated by astronomical events, which will compensate for daylight savings time and will have programmable setback periods relative to sunrise and sunset.
3. The system shall be capable of implementing On commands, Off commands, Raise (dimming) commands, Lower (dimming) commands for any relay, group or zone by means of digital wall switches, specification grade line voltage type wall switches, photocell, web-based software or other devices connected to programmable inputs in a lighting control panel.
4. Channels for grouping relays shall be provided, each with an associated pushbutton to toggle the channel ON/OFF and a terminal block for a separate dry contact input. Any number of relays in the panel can be assigned to each channel, with overlapping allowed. Channels shall be set up via communication line communications and networking. Each channel pushbutton shall provide LED status indication. The panel shall also have the ability to assign functions to relays independently of the channels. Panels shall be addressable with DIP switches or other local means to set panel address.
5. System shall accept any type of switch input, including momentary or maintained.
6. System shall support by relay or zone the "blink warning" function. System shall be capable of flashing lights Off/On prior to the lights being turned Off. The warning interval time between the flash and the final lights off signal shall be definable for each zone. Occupant shall be able to override any scheduled Off sweep using local wall switches within the occupied space. Occupant override time shall be locally and remotely programmable and shall not exceed two (2) hours.
7. System shall provide temporary override conditions for each relay or dimmer so that lights can always be turned on.
8. All programming and scheduling shall be able to be done locally at the parent lighting control panel and remotely via the Internet. Remote connection to the lighting control system shall provide real-time control and real-time feedback. Lighting control system shall be able to be monitored by and take commands from a remote PC. At any time, should the remote PC go offline, all system programming uploaded to the lighting control system shall continue to operate as intended.
9. All programs, schedules, time of day, etc., shall be held in non-volatile memory for a minimum of two (2) years at power failure. At restoration of power, lighting control system shall implement programs required by current time and date.
10. Lighting control shall be configured to allow individual users to turn lighting on and off with their PCs. Software shall be written for Windows operating system, with web page as the display and ActiveX controls that can be accessed through an Internet browser. Include at least three levels of password protection.

## 2.11 CENTRAL LIGHTING CONTROL INTERFACES

### A. SW-LV; Manual Switches, Stations and Plates:

1. Switches: Modular, momentary pushbutton, with addressable capabilities to control the luminaires assigned to that switch. The switch shall be able to actuate the functions based on the described sequence of operation and intended functions.
2. Preset/fader stations shall operate using programmable buttons and/or faders as indicated on drawings.
3. Integral Pilot Light or LED: Indicate that controls are active or powered by being on continuously when powered or when pushbuttons are actuated.
4. Labeling of buttons and faders shall be engraved/screened by manufacturer, using approved text returned with shop drawing submittals.
5. Station control components shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via direct or network connection. Function options include: preset selection, manual mode, record mode, station lockout, raise/lower, macro, cue, and room join/separate.

### B. LCD-; LCD Station:

1. Backlit color liquid crystal display (LCD) shall operate using buttons, faders, and other images on separate programmable control pages via touchscreen interface.
2. LCD station contrast and brightness shall be adjustable. It shall be possible to program the station to dim during periods of inactivity.
3. LCD stations shall support import of bitmap image files to customizable pages.
4. Permanently installed stations shall be either fully or semi-recessed in manufacturer-furnished backbox and trim assembly, with no visible fasteners or hardware.
5. Portable stations shall nest into permanent wall docking station furnished by manufacturer, and shall not require user to connect any umbilicals or plugs when inserting or removing the portable device. Docking station shall provide charging and communication with portable device when docked.

### C. Wireless Controls (Infrared):

1. Portable wireless IR transmitter for remote control of lighting control panel. Transmitter shall have at least four (4) scene control with engraved names below each button.
2. Infrared receiver shall be recess mounted with an integral LED to indicate when signal has been received. Receiver shall operate reliably within a 40-foot distance.

### D. Portable Control Console and Connector Station:

1. Portable control console with minimum 10-foot cable and interface plug.
2. Connector station receptacle, flush mounted, to allow portable console to communicate with lighting control system. Mounts in industry standard backbox.

### E. LS-N; Network Daylight Level Sensor:

1. Networked sensors shall serve as a measurement device that provides ongoing read-back of sensor settings to lighting control network or daylight controller. Refer to the sequence of operation for actions to be triggered at various read-back values.

2. Sensor shall be ceiling- or wall-mounted for range and viewing angle, meeting application requirements as outlined in the sequence of operation. Outdoor sensors shall be wet location listed and designed specifically for outdoor use.
3. Output signal from sensor shall be linear with light level. Network connection permits remote query of sensor status and value via control software. All adjustments, with the exception of sensor range, shall be made via network connection.
4. Sensor shall have adjustable sensitivity range to permit use as scheduled.

## **2.12 CONDUCTORS AND CABLES**

### **A. Control Wiring:**

1. Where installed with the line-voltage wiring, control wiring shall be copper conductors not smaller than No. 16 AWG with insulation voltage rating and temperature rating equal to that of the line-voltage wiring, complying with Division 26 Section 26 0513 "Wire and Cable."
2. Tap conductors to switches or relays: Stranded copper conductors of 16 AWG or solid 16 or 18 AWG with insulation rating equal to that of the line-voltage wiring.
3. Tap conductors to dimming ballasts: Solid copper conductors of 18 AWG with insulation voltage rating equal to that of the line-voltage wiring and insulation temperature rating not less than 90°C.
4. Network cabling as required by manufacturer.

### **B. Splices and Taps:**

1. Tapping or wire trap connectors shall be used to splice all Class 1 and Class 2 control wiring. Twist-on, wire-nut type connectors are not allowed.

## **PART 3 - EXECUTION**

### **3.01 PRE-CONSTRUCTION MEETING**

- A. Schedule a pre-construction meeting with the controls representative, installing contractor, Architect/Engineer, and Owner to explain the proposed lighting control centralized, wireless, and distributed systems.

### **3.02 EXAMINATION**

- A. Verify that surfaces are ready to receive work.
- B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts existing conditions.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and approved shop drawings.

- B. All wiring shall be installed in conduit. Class II low voltage control wiring may be open wiring and shall maintain 150 mm (6 inch) spacing from electronic ballast and other RFI/EMI sources.
- C. All branch load circuits shall be live tested before connecting the loads to the lighting control panel.

### **3.04 SUPPORT SERVICES**

- A. System Startup:
  - 1. Manufacturer shall provide factory authorized technician to confirm proper installation and operation of all system components.
- B. Testing:
  - 1. System shall be completely functional tested by a factory-authorized technician. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system components.
  - 2. Programming of initial zones, schedules, lighting levels, control station groups, and sensor settings shall be performed by a factory-authorized technician. Lighting Control Sequence of Operation shall serve as a basis for programming, However, all final decisions regarding groups and schedules shall be at the direction of the Owner. The following procedures shall be performed at a minimum:
    - a. Confirm occupancy sensor placement, sensitivity, and time delay settings to meet specified performance criteria.
    - b. Confirm daylight sensor placement, sensitivity, deadband, and delay settings to meet specified performance criteria.
    - c. Confirm that schedules and time controls are configured to meet specified performance criteria and Owner's operating requirements.
  - 3. Verify occupancy/vacancy and daylight sensor operation is correct after furniture and equipment is installed in each area. Make adjustments to sensor settings and time delays to allow proper operation.
  - 4. Verify occupancy/vacancy sensors are located to provide complete coverage for the area served with no nuisance switching.
    - a. Relocate sensors or provide additional sensors as necessary to provide adequate coverage.
    - b. Mask occupancy sensors where necessary to prevent nuisance switching from adjacent areas.
- C. Training:
  - 1. Manufacturer shall provide competent factory-authorized technician to train Owner personnel in the operation, maintenance and programming of the lighting control system. Submit training plan with notification seven (7) days prior to proposed training dates.
  - 2. Training duration shall be no less than three (3) days, with one (1) day being scheduled at least two (2) weeks after initial training.
- D. Documentation:
  - 1. Manufacturer shall provide system documentation including:



- a. System one-line showing all panels, number and type of control stations and sensors, communication line, and network or BMS/BAS interface unit.
- b. Drawings for each panel showing hardware configuration and numbering.
- c. Panel wiring schedules.
- d. Typical diagrams for each component.

**3.05 SYSTEM COMMISSIONING**

- A. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Section 01 0900, General Commissioning, for further details.
- B. System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Agent. Refer to Section 01 0900, General Commissioning, for system verification tests and commissioning requirements.
- C. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 01 0900, General Commissioning, for Contractor training requirements.

**END OF SECTION**

## SECTION 26 2300 - LOW-VOLTAGE SWITCHGEAR

### PART 1 - GENERAL

#### 1.01 RELATED SECTIONS AND WORK

- A. Refer to the One-Line Diagram for size, rating, and configuration.
- B. Section 26 0548 - Seismic Requirements for Equipment and Supports
- C. Section 26 4300 - Surge Protection Devices
- D. Section 26 0913 - Power Monitoring and Control

#### 1.02 QUALITY ASSURANCE

- A. Low voltage switchgear shall be completely factory assembled and metal enclosed. It shall consist of functionally compartmentalized units for removable power circuit breakers. The switchgear structure and breakers shall be the product of a single manufacturer.

#### 1.03 REFERENCES

- A. ANSI C37.16 - Low-Voltage Power Circuit-Breakers
- B. ANSI C37.17 - Trip devices for AC and General Purpose DC Low-Voltage Power Circuit-Breakers
- C. ANSI / IEEE C37.20.1 -Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
- D. ANSI C37.51, Switchgear - Metal-Enclosed Low-Voltage AC Power Circuit Breaker Switchgear Assemblies - Conformance Test Procedures
- E. NEMA SG-5 - Power Switchgear Assemblies
- F. NEMA SGH-3 - Low Voltage Circuit Breakers
- G. NFPA 70 - National Electrical Code (NEC)
- H. UL-1066 - Low-Voltage AC and DC Power Breakers Used in Enclosure

#### 1.04 SUBMITTALS

- A. Submit product data under provisions of Section 26 0500.
- B. Include plan, front, and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; switchgear instrument details; instructions for handling and installation of switchgear; and electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.

- C. Selective Coordination Study: Submit study to prove that all essential electrical systems, emergency systems and legally required standby system panelboards are selectively coordinated with all supply side overcurrent protective devices.
- D. Arc Energy Reduction Documentation: Submit documentation to demonstrate the arc energy reduction system is set to operate at a value below the available arcing current.
- E. Submit manufacturer's instructions under provisions of Section 26 0500.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to the site under provisions of Section 26 0500.
- B. Deliver in 48-inch maximum width shipping splits, unless approved otherwise by both the Contractor and Architect/Engineer, individually wrapped for protection, and mounted on shipping skids.
- C. Store and protect products under provisions of Section 26 0500.
- D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, condensation, construction debris, and traffic.
- E. Handle in accordance with NEMA PB2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

#### **1.06 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data under provisions of Section 26 0500.
- B. Include spare parts data listing, source and current prices of replacement parts and supplies, and recommended maintenance procedures and intervals.
- C. Submit operation and maintenance data based on factory and field testing, operation and maintenance of specified product.
- D. Perform ground fault protection system testing as required by Electrical Code. Submit testing results to the Architect/Engineer.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Square D Class 6037 Powerzone 4
- B. ABB AKD
- C. Eaton Magnum DS
- D. Siemens WL

## **2.02 RATINGS**

- A. The switchgear for this project shall be fully rated unless otherwise specifically noted in the specifications.

## **2.03 SWITCHGEAR CONSTRUCTION AND RATINGS**

- A. Factory-assembled, dead-front, low-voltage, metal-enclosed, and self-supporting switchgear assembly, and complete from incoming line terminals to load-side terminations.
- B. Switchgear electrical ratings and configurations as shown on the drawings. The entire assembly shall be suitable for 600-volt maximum AC service.
- C. Line and Load Terminations: Accessible, NEMA 2 hole lugs suitable for the conductor materials used, rated at 75°C.
- D. Main Section Devices: Individually mounted and compartmented.
- E. Distribution Section Devices: Safety shutters shall isolate breaker connections to the main bus when the breaker is removed.
- F. Auxiliary Section Devices: Individually mounted and compartmented.
- G. Bus Material: Copper with silver plating, sized in accordance with ANSI temperature rise criteria of 65°C over a 40°C ambient. Bus shall be extended to the maximum vertical height in each section.
- H. Bus Connections: Bolted, with Belleville-type washers. The bus arrangement shall be designed to permit future additions.
- I. Bus bars shall be fully isolated, braced for minimum ANSI 4-cycle short-circuit withstand rating of 65,000 ampere rms symmetrical.
- J. Provide a copper ground bus through the length of the switchboard, with a short time withstand rating equal to the largest circuit breaker in the assembly.
- K. Provide metering transformer compartment for Utility Company's use. Compartment size, bus spacing and drilling, door, and locking and sealing requirements shall be in accordance to Section 26 2000 and Utility Company specifications.
- L. Enclosure shall be NEMA 3R non-walk-in enclosure. Sections shall align at front and rear. Switchgear shall provide complete bottom enclosure, preventing the entrance of small animals or rodents. Provide hinged door with flush lock and all keyed alike. Door hardware shall provide swing clear operation (180-degree swing).
- M. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one-coat, corrosion-resisting paint, or plate with cadmium or zinc.
- N. Engraved identification nameplates for each breaker compartment and each control switch. Owner shall provide designation for breakers.

## **2.04 OVER-CURRENT PROTECTIVE DEVICES**

- A. Low-voltage Power Circuit Breakers with Microprocessor Trip Units: All power circuit breakers shall be UL 1066 listed for application in their intended enclosures for 100% of their continuous ampere rating. Provide power circuit breaker with two-step stored energy closing. Provide manual charging handle and electric charging motor where indicated as electrically operated. Electrically operated breakers shall be complete with 120V AC motor operators. The charging time of the motor shall not exceed six (6) seconds. Provide stationary mounting. The primary contacts shall have an easily accessible wear indicator to indicate contact erosion.

## **2.05 ARC ENERGY REDUCTION**

- A. Arc Energy Reduction:
  - 1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,200 amps or larger.
  - 2. Energy-Reducing Maintenance Switch: Provide an energy-reducing maintenance switch visual status indication when engaged. Install the maintenance switch in the first section of the electrical equipment.
- B. Arc Energy Reduction with Selective Coordination:
  - 1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,200 amps or larger.
  - 2. Energy-Reducing Maintenance Switch: Provide an energy-reducing maintenance switch visual status indication when engaged. Install the maintenance switch in the first section of the electrical equipment.
  - 3. Zone-Selective Interlocking System: Provide a zone-selective interlocking system for the electrical equipment. The system shall provide the following functions:
    - a. Selective coordination.
    - b. Permanent arc energy reduction.
  - 4. The following arc energy reduction system options are acceptable:
    - a. Zone-selective interlocking with permanent arc energy reduction.
    - b. Differential relaying with permanent arc energy reduction.
    - c. Listed energy-reducing active arch flash mitigating system.

## **PART 3 - EXECUTION**

### **3.01 FACTORY TESTING**

- A. The switchgear shall be completely assembled, wired, adjusted and tested at the factory. After assembly, the complete switchgear shall be tested to ensure the accuracy of the wiring and the functioning of all equipment. The main bus system shall be given a dielectric test of 2200 volts for one minute between live parts and ground and between opposite polarities.
- B. The wiring and control circuits shall be given a dielectric test of 1500 volts for one minute, or 1800 volts for one second, between live parts and ground, in accordance with ANSI C37.20.1.

- C. A certified test report of all standard production tests shall be shipped with each assembly.

**3.02 MANUFACTURER'S CERTIFICATION**

- A. A qualified, factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted, and tested in accordance with the manufacturer's recommendations.
- B. The Contractor shall provide three (3) copies of the manufacturer's representative's certification before final payment.

**3.03 TRAINING**

- A. The Contractor shall provide a training session for up to five (5) Owner's Representatives for 2 normal workdays at a jobsite location determined by the Owner.
- B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of the instruction on the operation of the assembly, circuit breakers, and major components within the assembly.

**3.04 ADJUSTING AND CLEANING**

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Touch up scratched or marred surfaces to match original finish.
- C. Provide time/current trip curves for all adjustable protection devices that require setting. Also provide curves and equipment information for associated new and existing fixed devices that require coordination with new protection devices. Submit time/current curves in hard copy or electronic format.
- D. Adjust trip and time delay settings to values as scheduled, or as instructed by the Architect/Engineer.
- E. Where two levels of ground fault are provided, test ground fault circuit breakers to prove selective coordination in accordance with manufacturer's directions. Provide testing documentation with Operating & Maintenance Manual submittals.

**END OF SECTION**

## SECTION 26 2413 - SWITCHBOARDS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Main and distribution switchboards: SB-#

#### 1.02 RELATED SECTIONS AND WORK

- A. Refer to the Electrical Distribution Diagram and Electrical Schedules for size, rating, and configuration.

#### 1.03 REFERENCES

- A. ANSI C12 - Code for Electricity Metering
- B. ANSI C39.1 - Requirements for Electrical Analog Indicating Instruments
- C. ANSI C57.13 - Requirements for Instrument Transformers
- D. NEMA AB 1 - Molded Case Circuit Breakers
- E. NEMA KS 1 - Enclosed Switches
- F. NEMA PB 2 - Dead Front Distribution Switchboards
- G. NEMA PB 2.1 - Instructions for Safe Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or less

#### 1.04 SUBMITTALS

- A. Submit product data under provisions of Section 26 0500.
- B. Include front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; switchboard instrument details; instructions for handling and installation of switchboard; and electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.
- C. Selective Coordination Study: Submit study to prove that all essential electrical systems, emergency systems and legally required standby system panelboards are selectively coordinated with all supply side overcurrent protective devices.
- D. Arc Energy Reduction Documentation: Submit documentation to demonstrate the arc energy reduction system is set to operate at a value below the available arcing current.
- E. Submit manufacturer's instructions under provisions of Section 26 0500.

### **1.05 SPARE PARTS**

- A. Keys: Furnish four each to the Owner.

### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to the site under provisions of Section 26 0500.
- B. Deliver in 48-inch maximum width shipping splits, unless approved otherwise by both the Contractor and Architect/Engineer, individually wrapped for protection, and mounted on shipping skids.
- C. Store and protect products under provisions of Section 26 0500.
- D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with NEMA PB2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

### **1.07 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data under provisions of Section 26 0500.
- B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

- A. Approved Manufacturers:
  - 1. Square D Class 2700 QED-2, I-Line, Powerstyle
  - 2. ABB Spectra / Evolution
  - 3. Siemens
  - 4. Eaton

### **2.02 RATINGS**

- A. Definitions:
  - 1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. Refer to Section 26 0553 for additional requirements.
  - 2. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.



- B. The switchboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

### **2.03 SWITCHBOARD CONSTRUCTION AND RATINGS**

- A. Factory-assembled, dead front, metal-enclosed, and self-supporting switchboard assembly conforming to NEMA PB2, and complete from incoming line terminals to load-side terminations.
- B. Switchboard electrical ratings and configurations as shown on the drawings.
- C. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials used.
- D. Main Section Devices: Individually mounted and compartmented.
- E. Distribution Section Devices: Group mounted.
- F. Auxiliary Section Devices: Individually mounted and compartmented.
- G. Bus Material: Aluminum with tin plating, sized in accordance with NEMA PB 2.
- H. Bus Connections: Bolted, accessible from front only for maintenance. Plug-on connections may be utilized with Architect/Engineer's pre-approval by addenda.
- I. Bus bars shall be fully isolated, braced for minimum ampere rms symmetrical rating as indicated on drawings.
- J. The bus shall extend the full height of the distribution sections to provide space for future breakers.
- K. Provide a 1 X 1/4-inch copper ground bus through the length of the switchboard.
- L. Provide metering transformer compartment for Utility Company's use. Compartment size, bus spacing and drilling, door, and locking and sealing requirements shall be in accordance to Section 26 2000 and Utility Company specifications.
- M. Enclosure shall be NEMA PB 2; Type 1 - General-Purpose. Sections shall align at front and rear. Provide removable panel access or hinged door with flush lock and all keyed alike. Door hardware shall provide swing clear operation (180-degree swing).
- N. Switchboard Height: NEMA PB 2; 92 inches, excluding floor sills, lifting members and pull boxes.
- O. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
- P. Pull Box: Same construction as switchboard, size as shown on the drawings. Top and sides shall be removable. Insulating, fire-resistive bottom with separate openings for each circuit to pass into switchboard.
- Q. Pull Section: Same construction as switchboard, size as shown on the drawings. Depth and height to match switchboard. Arrange as shown on the drawings.

- R. Future Provisions: In addition to the spare devices shown, provide a minimum of 15 inches of fully equipped space for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Continuous current rating as indicated on the drawings.
- S. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

#### **2.04 SWITCHING, OVER-CURRENT PROTECTIVE DEVICES, AND ARC ENERGY REDUCTION**

- A. Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide breaker interrupting ratings as indicated on the plans. Where necessary to meet interrupting ratings, breakers shall be provided with automatically resetting current limiting elements in each pole.
- B. Arc Energy Reduction with Selective Coordination:
  - 1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,200 amps or larger.
  - 2. Energy-Reducing Maintenance Switch: Provide an energy-reducing maintenance switch visual status indication when engaged. Install the maintenance switch in the first section of the electrical equipment.
  - 3. The following selective coordination and arc energy reduction system options are acceptable:
    - a. Zone-selective interlocking with permanent arc energy reduction
    - b. Differential relaying with permanent arc energy reduction
    - c. Listed energy-reducing active arch flash mitigating system

#### **2.05 INSTRUMENTS AND SENSORS**

- A. Ground Fault Sensor: Zero sequence type.
- B. Ground Fault Relay: Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install switchboard in locations shown on the drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.
- B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- C. Install fuses in each switch.

#### **3.02 FIELD QUALITY CONTROL**

- A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

- B. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each. Test voltage shall be 1000 volts, and minimum acceptable value for insulation resistance is 2 megohms.
- C. Check tightness of accessible bolted bus joints using a calibrated torque wrench. Tightness shall be in accordance with manufacturer's recommended values.
- D. Physically test key interlock systems to ensure proper function.

### **3.03 ADJUSTING AND CLEANING**

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Touch up scratched or marred surfaces to match original finish.
- C. Provide time/current trip curves for all adjustable protection devices that require setting. Also provide curves and equipment information for associated new and existing fixed devices that require coordination with new protection devices. Submit time/current curves in hard copy or electronic format.
- D. Adjust trip and time delay settings to values as scheduled, or as instructed by the Architect/Engineer.
- E. Where two levels of ground fault are provided, test ground fault circuit breakers to prove selective coordination in accordance with manufacturer's directions. Provide testing documentation with Operating & Maintenance Manual submittals.

**END OF SECTION**

## SECTION 26 2416 - PANELBOARDS

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Service and distribution panelboards: DP-#, DP-#
- B. Lighting and appliance branch circuit panelboards: Panel '###'

#### 1.02 RELATED SECTIONS AND WORK

- A. Refer to the Electrical Distribution Diagram and Electrical Schedules for size, rating, and configuration.

#### 1.03 REFERENCES

- A. NEMA AB 1 - Molded Case Circuit Breakers
- B. NEMA FU 1 - Low voltage cartridge fuses
- C. NEMA KS 1 - Enclosed Switches
- D. NEMA PB 1 - Panelboards
- E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
- F. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment
- G. UL 248 - Low-Voltage Fuses
- H. UL 67 - Panelboards

#### 1.04 SUBMITTALS

- A. Submit shop drawings for equipment and component devices under provisions of Section 26 0500.
- B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Selective Coordination Study: Submit study to prove that all essential electrical systems, emergency systems and legally required standby system panelboards are selectively coordinated with all supply side overcurrent protective devices.
- D. Arc Energy Reduction Documentation: Submit documentation to demonstrate the arc energy reduction system is set to operate at a value below the available arcing current.
- E. Refurbished branch panel enclosure documentation for new branch panelboards installed in existing enclosures.

- F. Submit manufacturer's instructions under provisions of Section 26 0500.

## **1.05 SPARE PARTS**

- A. Keys: Furnish four (4) each to the Owner.
- B. Fuses: Furnish 10% or a minimum of three (3) spare fuses of each type and rating installed to the Owner.
- C. Fuse Pullers: Furnish one (1) fuse puller to the Owner.

## **PART 2 - PRODUCTS**

### **2.01 RATINGS**

- A. Definitions:
  - 1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. See Section 26 0553 for additional requirements.
  - 2. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.
- B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

### **2.02 MAIN AND DISTRIBUTION PANELBOARDS**

- A. General
  - 1. Manufacturers:
    - a. Square D QMB, I-Line
    - b. ABB ReliaGear Entelleon
    - c. Siemens F2, P4
    - d. Eaton PRL4, PRL5
- B. Panelboards: NEMA PB 1; type as shown on the drawings.
- C. Enclosure: NEMA PB 1; Type 1.
- D. Provide cabinet front with concealed trim clamps and hinged trim on door to allow access to wiring gutters without removal of trim and flush lock. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with aluminum bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.
- F. All spaces shown on the one-line diagram shall be fully prepared spaces for future breakers.

- G. Minimum Integrated Short Circuit Rating: 100,000 amperes rms symmetrical for 240-volt panelboards; 50,000 amperes rms symmetrical for 480-volt panelboards, or as shown on the drawings.
- H. Fusible Switch Assemblies: NEMA KS 1; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- I. Fuse Clips (Switches 600 Amperes and Smaller): Provide with Class 'R' rejection clips. Fuse Clips (601 Amperes and Larger): Designed to accommodate Class 'L' fuses.
- J. Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole.
- K. Arc Energy Reduction:
  - 1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,200 amps or larger.
  - 2. Energy-Reducing Maintenance Switch: Provide an energy-reducing maintenance switch visual status indication when engaged. Install the maintenance switch in the first section of the electrical equipment.
- L. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

## **2.03 BRANCH CIRCUIT PANELBOARDS**

- A. General
  - 1. Manufacturers:
    - a. Square D NQ, NF
    - b. ABB A Series
    - c. Siemens P1
    - d. Eaton PRL1, PRL2
- B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
- C. Enclosure: NEMA PB 1; Type 1.
- D. Provide cabinet front with door-in-door construction, concealed hinge, and flush lock all keyed alike. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with copperbus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.
- F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.
- G. All multiple-section panelboards shall have the same dimensional back box and cabinet front size.

- H. Minimum Integrated Short Circuit Rating: As shown on the drawings.
- I. Provide handle lock-on devices for all breakers serving exit sign and lighting circuits with emergency battery units. Provide handle lock-on devices and red handles for breakers serving fire alarm panels.
- J. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.
- K. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.
- L. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

#### **2.04 ACCESSORIES**

- A. Provide REQUIRED accessories as described below. Provide SCHEDULED accessories when listed with plan schedules. Refer to plan schedules for additional requirements.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install panelboards plumb as indicated on the drawings in conformance with NEMA PB 1.1.
- B. Height: 6 feet to handle of highest device.
- C. Provide filler plates for unused spaces in panelboards.
- D. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEIPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.
- E. Stub five (5) empty one-inch conduits to accessible location above ceiling out of each recessed panelboard.

#### **3.02 REFURBISHED ENCLOSURES - NEW PANELBOARDS**

- A. Existing panelboard enclosures may be reused to house new panelboards pending documented verification of the following provided with the applicable new equipment submittals.
  1. New branch panelboard is listed for the existing enclosure or application.
  2. Existing enclosure and new equipment is field evaluated by the manufacturer or nationally recognized testing laboratory for the available fault current, condition, and application.

3. Authority Having Jurisdiction AHJ approval.

**3.03 FIELD QUALITY CONTROL**

- A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

**END OF SECTION**



## SECTION 26 2726 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Device plates and box covers
- B. Receptacles (REC-#)
- C. Floor boxes and floor box with service fitting (FB-#)
- D. Poke-through fittings (PT-#)
- E. Pendant cord/connector devices
- F. Cord and plug sets
- G. Cord reel (CR-#)

#### 1.02 QUALITY ASSURANCE

- A. Provide similar devices from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Electrical Code, by a testing agency to Authorities Having Jurisdiction and marked for intended use.
- C. Comply with the Electrical Code.

#### 1.03 REFERENCES

- A. DSCC W-C-896F - General Specification for Electrical Power Connector
- B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet
- C. NEMA WD 1 - General Color Requirements for Wiring Devices
- D. NEMA WD 6 - Wiring Devices - Dimensional Requirements
- E. NFPA 70 - National Electrical Code (NEC)
- F. UL 498 - Standard for Attachment Plugs and Receptacles
- G. UL 943 - Standard for Ground Fault Circuit Interrupters

#### 1.04 SUBMITTALS

- A. Submit product data under provisions of Section 26 0500.

- B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

### **1.05 COORDINATION**

- A. Receptacles for Owner Furnished Equipment: Match plug configurations.
- B. Cord and Plug Sets: Match equipment requirements.
- C. Coordinate installation of receptacle assemblies in countertops and furniture with the Contractor providing the countertop or furniture. Contractor shall coordinate penetrations and conduit routing in countertops and furniture with drawings and other obstacles below the installation surface.

## **PART 2 - PRODUCTS**

### **2.01 DEVICE COLOR**

- A. All switch, receptacle, and outlet colors shall be verified with Architect, unless indicated otherwise.

### **2.02 COVERPLATES**

- A. All switches, receptacles, and outlets shall be complete with the following:
  - 1. Unbreakable thermoplastic/thermoset plastic and match device color coverplates in finished spaces where walls are finished.
  - 2. Decorator Grade - Public: Decorator thermoset plastic and match device color wallplates in public finished spaces where walls are finished.
    - a. Manufacturer:
      - 1) Leviton Decora
      - 2) Hubbell Decorator
      - 3) Cooper Decorator
      - 4) or approved equal
  - 3. #302 stainless steel coverplates in unfinished spaces for flush boxes.
  - 4. Galvanized steel coverplates in unfinished spaces for surface mounted boxes.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
- C. Install nameplate identification as indicated in Section 26 0553.
- D. Plate securing screws shall be metal with head color matching the wall plate finish.

### **2.03 MODULAR CONNECTORS**

- A. Devices listed below are traditional wired devices. Contractor option to provide equivalent modular connector-type devices (Hubbell Snap Connect, Pass & Seymour Plug Tail, Leviton Lev-Lock, Copper ArrowLink) where applicable.

- B. Wiring devices with modular wiring type quick connectors shall comply with the following in addition to the above:
  - 1. Wired with #12 THHN Cu, stranded or solid, 3 or 4 wire as required for device, minimum 6" lead length.
  - 2. Connector contacts shall be crimped or welded.

## 2.04 RECEPTACLES

- A. Refer to Electrical Symbols List for device type.
- B. REC-DUP: NEMA 5-20R Duplex Receptacle:
  - 1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and steel back strap.
    - a. Manufacturers:
      - 1) Hubbell 5352A
      - 2) Leviton, 5362-S
      - 3) Pass & Seymour 5362
      - 4) Cooper 5352
  - 2. Decorator Grade: Provide decorative style duplex receptacles in public spaces where walls are finished.
    - a. Manufacturers:
      - 1) Hubbell DR20
      - 2) Leviton 16362
      - 3) Pass & Seymour 26342
      - 4) Cooper 6352
  - 3. Spec Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and brass back strap.
    - a. Manufacturers:
      - 1) Hubbell 5352
      - 2) Leviton 5362-S
      - 3) Pass & Seymour 5362
      - 4) Cooper 5362
- C. REC-DUP-GFI: NEMA 5-20R Ground Fault Duplex Receptacle:
  - 1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, listed.
    - a. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
    - b. Manufacturers:
      - 1) Hubbell GF20L
      - 2) Leviton GFNT2

- 3) Pass & Seymour 2097
- 4) Cooper SGF20

D. REC-DUP-GFI-R: Remote Ground Fault Device:

- 1. Ground fault device for remote downstream receptacles. 125-volt, 20 amp. Test and reset buttons in impact resistance thermoplastic face, listed.
  - a. Manufacturers:
    - 1) Hubbell GFBF20
    - 2) Leviton 6895
    - 3) Pass & Seymour 2085
    - 4) Cooper VGFD20

E. REC-DUP-WP: NEMA 5-20R Weatherproof Ground Fault Duplex Receptacle:

- 1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, weather resistant WR listed. Provide extra-duty NEMA 3R rated while-in-use clear cover.
- 2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
  - a. Manufacturers:
    - 1) Hubbell:
      - a) GFTWRST20 with clear housing RW57300
      - b) GFCI type devices are not allowed. Contractor may substitute an alternative manufacturer when Hubbell is the basis of submittal for all other wiring devices.
    - 2) Leviton GFWT2 with clear housing 5977-CL
    - 3) Pass & Seymour 2097TRWR with clear housing WIUC10-C
    - 4) Cooper WRSGF20 with clear housing WIU-1

F. REC-USB: NEMA 5-20R Receptacle with USB Charger:

- 1. Standard Grade Type A USB: 125-volt, 20-amp, tamper resistant, 3-wire grounding type with impact resistant thermoplastic face. Type A USB charging rated at 5VDC 3.0A minimum. Mounted in double gang backbox.
  - a. Manufacturers:
    - 1) Hubbell USB20X2
    - 2) Pass & Seymour TR5362USB
    - 3) Cooper TR7766

G. REC-AFGF: NEMA 5-20R Duplex Receptacle with Arc Fault Circuit Interrupter, Ground Fault Circuit Interrupter, and Tamper Resistant:

- 1. 125-volt, 20 amp, 3-wire grounding type specification grade, arc fault circuit interrupter, ground fault circuit interrupter, tamper resistant receptacle with test and reset buttons in impact resistant thermoplastic face, listed.

- a. Device shall perform self-test of GFCI circuitry in accordance with UL-943.
- b. Manufacturers:
  - 1) Hubbell AFGF
  - 2) Leviton AGTR2
  - 3) Pass & Seymour AFGF202
  - 4) Cooper TRAFGF20A

H. REC-ARC: NEMA 5-20R Receptacle with Arc Fault Circuit Interrupts:

- 1. 125-volt, 20 amp, 3-wire grounding type specification grade, arc fault circuit interrupter receptacle and tamper resistant with test and reset buttons in impact resistant thermoplastic face.
  - a. Manufacturers:
    - 1) Hubbell AFR20
    - 2) Leviton AFTR2
    - 3) Pass & Seymour AF202
    - 4) Cooper TRAFCI20

I. REC-SIM-520R: NEMA 5-20R Simplex Receptacle:

- 1. 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face.
  - a. Manufacturers:
    - 1) Hubbell HBL5361
    - 2) Leviton 5361
    - 3) Pass & Seymour 5361
    - 4) Cooper 5361

J. REC-SIM-530R: NEMA 5-30R Simplex Receptacle:

- 1. 125-volt, 30 amp, 3-wire grounding type, phenolic face.
  - a. Manufacturers:
    - 1) Hubbell HBL9308
    - 2) Leviton 5371
    - 3) Pass & Seymour 3802
    - 4) Cooper 5716N

K. REC-SIM-550R: NEMA 5-50R Simplex Receptacle:

- 1. 125-volt, 50 amp, 3-wire grounding type, phenolic face.
  - a. Manufacturers:
    - 1) Hubbell HBL9360
    - 2) Cooper 1253

- L. REC-SIM-620R: NEMA 6-20R Simplex Receptacle:
  - 1. 250-volt, 20 amp, 2-pole, 3-wire grounding type with thermoplastic face.
    - a. Manufacturers:
      - 1) Hubbell HBL5461
      - 2) Leviton 5461
      - 3) Pass & Seymour 5871
      - 4) Cooper 5461
  
- M. REC-SIM-630R: NEMA 6-30R Simplex Receptacle:
  - 1. 250-volt, 30 amp, 2-pole, 3-wire grounding type with thermoplastic face.
    - a. Manufacturers:
      - 1) Hubbell HBL9330
      - 2) Leviton 5372
      - 3) Pass & Seymour 3801
      - 4) Cooper 5700N
  
- N. REC-SIM-650R: NEMA 6-50R Simplex Receptacle:
  - 1. 250-volt, 50 amp, 2-pole, 3-wire grounding type with thermoplastic face.
    - a. Manufacturers:
      - 1) Hubbell HBL9367
      - 2) Leviton 5374
      - 3) Pass & Seymour 3804
      - 4) Cooper 5709N
  
- O. REC-SIM-720R: NEMA 7-20R Simplex Receptacle:
  - 1. 277-volt, 20 amp, 2-pole, 3-wire grounding type with thermoplastic face.
    - a. Manufacturers:
      - 1) Hubbell
      - 2) Leviton
      - 3) Pass & Seymour 7621
  
- P. REC-SIM-730R: NEMA 7-30R Simplex Receptacle:
  - 1. 277-volt, 30 amp, 2-pole, 3-wire grounding type with thermoplastic face.
    - a. Manufacturers:
      - 1) Hubbell HBL9315
      - 2) Leviton 9730-A
      - 3) Pass & Seymour
      - 4) Cooper 5795N

Q. REC-SIM-750R: NEMA 7-50R Simplex Receptacle:

1. 277-volt, 50 amp, 2-pole, 3-wire grounding type with thermoplastic face.

- a. Manufacturers:

- 1) Hubbell HBL9365
- 2) Leviton 9750-A
- 3) Pass & Seymour
- 4) Cooper

R. REC-SIM-1420R: NEMA 14-20R Simplex Receptacle:

1. 125/250-volt, 20 amp, 3-pole, 4-wire grounding type with thermoplastic face.

- a. Manufacturers:

- 1) Hubbell HBL8410
- 2) Pass & Seymour 3820
- 3) Cooper 5759

S. REC-SIM-1430R: NEMA 14-30R Simplex Receptacle:

1. 125/250-volt, 30 amp, 3-pole, 4-wire grounding type with thermoplastic face. Flush mounted at +24 AFF.

- a. Manufacturers:

- 1) Hubbell HBL9430A
- 2) Leviton 278
- 3) Pass & Seymour 3864
- 4) Cooper 5744N

T. REC-SIM-1450R: NEMA 14-50R Simplex Receptacle:

1. 125/250-volt, 50 amp, 3-pole, 4-wire grounding type with thermoplastic face. Flush mounted at +4" AFF.

- a. Manufacturers:

- 1) Hubbell HBL9450A
- 2) Leviton 279
- 3) Pass & Seymour 3894
- 4) Cooper 5754N

U. REC-SIM-1460R: NEMA 14-60R Simplex Receptacle:

1. 125/250-volt, 60 amp, 3-pole, 4-wire grounding type with thermoplastic face.

- a. Manufacturers:

- 1) Hubbell HBL9460A
- 2) Leviton 9460

- 3) Pass & Seymour
- 4) Cooper 9460N

V. REC-SIM-1520R: NEMA 15-20R Simplex Receptacle:

- 1. 250-volt, 20 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.

- a. Manufacturers:

- 1) Hubbell HBL8420
- 2) Leviton
- 3) Pass & Seymour
- 4) Cooper

W. REC-SIM-1530R: NEMA 15-30R Simplex Receptacle:

- 1. 250-volt, 30 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.

- a. Manufacturers:

- 1) Hubbell HBL8430A
- 2) Leviton 8430
- 3) Pass & Seymour 5740
- 4) Cooper 8430N

X. REC-SIM-1550R: NEMA 15-50R Simplex Receptacle:

- 1. 250-volt, 50 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.

- a. Manufacturers:

- 1) Hubbell HBL8450A
- 2) Leviton 8450
- 3) Pass & Seymour 5750
- 4) Cooper 8450N

Y. REC-SIM-1560R: NEMA 15-60R Simplex Receptacle:

- 1. 250-volt, 60 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.

- a. Manufacturers:

- 1) Hubbell HBL9460A
- 2) Pass & Seymour 5760
- 3) Cooper 8460N

Z. REC-SIM-L520R: NEMA L5-20R Simplex Receptacle, Locking Type:

- 1. 125-volt, 20 amp, 2-pole, 3-wire grounding type with impact resistant thermoplastic face.

- a. Manufacturers:

- 1) Hubbell
- 2) Leviton



- 3) Pass & Seymour L520
- 4) Cooper CWL520R

AA. REC-SIM-L530R: NEMA L5-30R Simplex Receptacle Locking Type:

- 1. 125-volt, 30 amp, 2-pole, 3-wire grounding type with impact resistant thermoplastic face.

- a. Manufacturers:

- 1) Hubbell
- 2) Leviton
- 3) Pass & Seymour L530
- 4) Cooper CWL530R

BB. REC-SIM-L620R: NEMA L6-20R Locking Type Simplex Receptacle:

- 1. 250-volt, 20 amp, 2-pole, 3-wire grounding type with thermoplastic face.

- a. Manufacturers:

- 1) Hubbell HBL2320
- 2) Leviton 2320
- 3) Pass & Seymour L620R
- 4) Cooper CWL620R

CC. REC-SIM-L630R: NEMA L6-30R Locking Type Simplex Receptacle:

- 1. 250-volt, 30 amp, 2-pole, 3-wire grounding type with thermoplastic face.

- a. Manufacturers:

- 1) Hubbell HBL2620
- 2) Leviton 2620
- 3) Pass & Seymour L630R
- 4) Cooper CWL630R

DD. REC-SIM-L720R: NEMA L7-20R Locking Type Simplex Receptacle:

- 1. 277-volt, 20 amp, 2-pole, 3-wire grounding type with thermoplastic face.

- a. Manufacturers:

- 1) Hubbell HBL2330
- 2) Leviton 2330
- 3) Pass & Seymour L720R
- 4) Cooper CWL720R.

EE. REC-SIM-L730R: NEMA L7-30R Locking Type Simplex Receptacle:

- 1. 277-volt, 30 amp, 2-pole, 3-wire grounding type with thermoplastic face.

- a. Manufacturers:

- 1) Hubbell HBL2630

- 2) Leviton 2630
- 3) Pass & Seymour L730R
- 4) Cooper CWL730R

FF. REC-SIM-L1420R: NEMA L14-20R Locking Type Simplex Receptacle:

1. 125/250-volt, 20 amp, 3-pole, 4-wire grounding type with thermoplastic face.
  - a. Manufacturers:
    - 1) Hubbell HBL 2410
    - 2) Pass & Seymour L1420
    - 3) Cooper CWL1420R

GG. REC-SIM-L1430R: NEMA L14-30R Locking Type Simplex Receptacle:

1. 125/250-volt, 30 amp, 3-pole, 4-wire grounding type with thermoplastic face.
  - a. Manufacturers:
    - 1) Hubbell HBL 2710
    - 2) Leviton 2710
    - 3) Pass & Seymour L1430R
    - 4) Cooper CWL1430R

HH. REC-SIM-L1520R: NEMA L15-20R Locking Type Simplex Receptacle:

1. 250-volt, 20 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.
  - a. Manufacturers:
    - 1) Hubbell HBL2420
    - 2) Leviton 2420
    - 3) Pass & Seymour L1520R
    - 4) Cooper CWL1520R

II. REC-SIM-L1530R: NEMA L15-30R Locking Type Simplex Receptacle:

1. 250-volt, 30 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.
  - a. Manufacturers:
    - 1) Hubbell HBL2720
    - 2) Leviton 2720
    - 3) Pass & Seymour L1530R
    - 4) Cooper CWL1530R

JJ. REC-SIM-L1620R: NEMA L16-20R Locking Type Simplex Receptacle:

1. 480-volt, 20 amp, 3-pole, 4-wire grounding type with thermoplastic face.
  - a. Manufacturers:
    - 1) Hubbell HBL2431

- 2) Pass & Seymour L1620R
- 3) Cooper CWL1620R

KK. REC-SIM-L1630R: NEMA L16-30R Locking Type Simplex Receptacle:

1. 480-volt, 30 amp, 3-pole, 4-wire grounding type with thermoplastic face.

a. Manufacturers:

- 1) Hubbell HBL2730
- 2) Leviton 2730
- 3) Pass & Seymour L1630R
- 4) Cooper CWL1630R

LL. REC-SIM-L2120R: NEMA L21-20R Locking Type Simplex Receptacle:

1. 120/208Y 3 phase 20-amp 5 wire grounding type.

a. Manufacturers:

- 1) Hubbell HBL2510
- 2) Cooper CWL2120R
- 3) Pass & Seymour L2120R

MM. REC-SIM-L2130R: NEMA L21-30R Locking Type Simplex Receptacle:

1. 120/208Y 3 phase 30-amp 5 wire grounding type.

a. Manufacturers:

- 1) Hubbell HBL2750
- 2) Cooper CWL2130R
- 3) Pass & Seymour L2130R

NN. REC-SIM-XP: NEMA 5-20R Explosion Proof Simplex Receptacle:

1. 125-volt, 20 amp, 3-wire grounding type, Class 1, Division 1, Group C rated. Factory sealed, dead end.

a. Manufacturers:

- 1) Appleton CPE1-2375
- 2) Crouse-Hinds CPS152201
- 3) Killark KRS-215-220

OO. REC-TAMP: NEMA 5-20R Tamper Resistant Duplex Receptacle:

1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face.

a. Manufacturers:

- 1) Hubbell BR20TR
- 2) Leviton TBR20

- 3) Pass & Seymour TR5362
    - 4) Cooper TRBR20
  - 2. Decorative Grade: Provide decorative style duplex tamper resistant receptacles in public spaces, guest rooms where walls are finished.
    - a. Manufacturers:
      - 1) Hubbell DR20TR
      - 2) Leviton TDR20
      - 3) Pass & Seymour TR2635
- PP. REC-TAMP-GFI: NEMA 5-20R GFI Tamper Resistant Receptacle:
- 1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type tamper-resistant with test and reset buttons in impact resistant thermoplastic face, listed.
    - a. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
    - b. Manufacturers:
      - 1) Hubbell GFTR20
      - 2) Cooper TRSGF20
      - 3) Pass & Seymour 2097TR
      - 4) Leviton GFTR2
- QQ. REC-TAMP-QUAD: NEMA 5-20R Double Duplex Tamper Resistant Receptacle:
- 1. Consists of two duplex tamper resistant receptacles, double gang box, plaster ring and faceplate.
    - a. Manufacturers:
      - 1) Refer to Tamper Resistant Receptacle above.
- RR. REC-QUAD-O: NEMA 5-20R Plug Load Controlled Duplex Receptacle:
- 1. Consists of two plug load controlled duplex receptacles, double gang box, plaster ring and faceplate.
    - a. Manufacturers:
      - 1) Refer to Plug Load Controlled Duplex Receptacle above.
- SS. REC-QUAD-IL: NEMA 5-20R Double Illuminated Face Duplex Receptacle:
- 1. Consists of two illuminated face duplex receptacles, double gang box, plaster ring and faceplate.
    - a. Manufacturers:
      - 1) Refer to Duplex Illuminated Face Receptacle above.

- TT. REC-QUAD: NEMA 5-20R Double Duplex Receptacle:
1. Consists of two duplex receptacles, double gang box, plaster ring and faceplate.
    - a. Manufacturers:
      - 1) Refer to Duplex Receptacle above.
- UU. REC-QUAD-GFI: NEMA 5-20R Double Duplex GFI Receptacle:
1. Consists of two duplex GFI receptacles, double gang box, plaster ring and faceplate.
    - a. Manufacturers:
      - 1) Refer to Duplex GFI Receptacle above.
- VV. REC-QUAD-USB: NEMA 5-20R Double Duplex USB Receptacle:
1. Consists of two duplex USB receptacles, double gang box, plaster ring and faceplate.
    - a. Manufacturers:
      - 1) Refer to USB Receptacle above.
- WW. REC-QUAD-WP: NEMA 5-20R Weatherproof Ground Fault Quad Receptacle:
1. Consists of two duplex, GFCI receptacles. Double gang box. Provide extra-duty NEMA 3R rated while-in-use cast aluminum cover.
    - a. Manufacturers:
      - 1) Receptacle: Refer to GFCI Receptacle above.
      - 2) Cover:
        - a) Intermatic WP1030MXD
        - b) Pass & Seymour WIUCAST2
        - c) Thomas & Betts Red Dot 2CKU
- XX. REC-XR#: 600-volt, 60 amp, 3-pole, 4-wire Locking Type Simplex Receptacle for X-ray Isolated Power Equipment:
1. Black nylon or polycarbonate face. Cast aluminum surface mounted box, 45° angle adapter, weather protective lift cover on receptacle.
    - a. Manufacturers:
      - 1) Hubbell HBL26410-RECP/HBL26401-BOX/HBL26404-ADAPTER
      - 2) Pass & Seymour 26420/26401/26404
      - 3) Cooper 26420/26401/26404
- YY. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.

- ZZ. Side wired devices shall have four binding screws that are undercut for positive wire retention.
- AAA. Ground fault circuit interrupter (GFCI) receptacles shall be listed and comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.
- BBB. Isolated ground receptacles shall have the equipment ground contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from the mounting strap.
- CCC. Integral surge suppression receptacles with integral surge suppression shall comply with the following:
  - 1. Category A3 listed.
  - 2. Line to ground, line to neutral, and neutral to ground modes.
  - 3. Metal-oxide varistors with a nominal clamp level rating of 500 volts and minimum single transient pulse energy dissipation of 210 joules per mode.
  - 4. Status indication: Light visible in the face of the device and audible alarm to indicate device is no longer active or in service.
  - 5. Distinctive symbol on device face to denote SPD-type device.
  - 6. Device shall be blue with blue coverplate.
  - 7. NEMA 5-20R duplex receptacle, 125-volt, 20 amp, 3-wire grounding type heavy duty industrial grade with impact resistant thermoplastic face and one-piece brass back strap.
    - a. Manufacturers:
      - 1) Hubbell HBL5362SA
      - 2) Leviton
      - 3) Pass & Seymour
      - 4) Cooper
- DDD. Hazardous (Classified) location receptacles shall comply with NEMA FB 11.

**2.05 COUNTERTOP AND FURNITURE RECEPTACLE ASSEMBLIES**

- A. REC-#: Pop-up Style Receptacle Assembly Listed for Countertop Applications.
  - 1. 125-volt, 15/20-amp, tamper resistant, 3-wire grounding type with impact resistant thermoplastic face. Two (2) NEMA 5-15R/5-20R, with both simplex devices on same face or opposite face of assembly, gasketed countertop enclosure, UL 948 section 146 spill test. Architect to select finish from standard factory options. Device(s) installation, orientation, and finish shall be coordinated with Architect/Engineer prior to installation. Provide mockup installation for review and acceptance.
  - 2. Product Specific Coordination:
    - a. The Contractor shall provide provisions as required to maintain the product listing. Refer to the manufacturer's instructions for a complete list of product specific installation requirements.
    - b. Hubbell: Provide GFCI circuit breaker for overcurrent protection device serving branch circuit.

- c. Lew Electric: Provide a REC-DUP-GFI in the cabinet cavity below the countertop for the device to plug into. Coordinate installation of the duplex device with the space available in the below countertop cabinet.
- d. Branch Circuit: Provide a 15A/1P circuit breaker for 15 amp rated devices served by a dedicated branch circuit.

3. Manufacturers:

- a. Hubbell RCT200
- b. Lew Electric PUR20

B. REC-#: Pop-up Style Receptacle Assembly Listed for Furniture Installation.

- 1. 125-volt, 15/20-amp, tamper resistant, 3-wire grounding type with impact resistant thermoplastic face. Two (2) NEMA 5-15R/5-20R, with both simplex devices on same face of assembly. Two (2) Type A USB charging rated at 5VDC 3.0A minimum. Mounted in 5"x5"x5" maximum pop-up enclosure. Architect to select finish from standard factory options.
- 2. Device(s) installation, orientation, and finish shall be coordinated with Architect/Engineer prior to installation. Provide mockup installation for review and acceptance.
- 3. Product Specific Coordination:

- a. The Contractor shall provide provisions as required to maintain the product listing. Refer to the manufacturer's instructions for a complete list of product specific installation requirements.
- b. Hubbell: Provide a REC-DUP-GFI in the cabinet cavity below the countertop for the device to plug into. Coordinate installation of the duplex device with the space available in the below countertop cabinet.
- c. Lew Electric: Provide gfi circuit breaker for overcurrent protection device serving branch circuit.
- d. Wiremold: Provide GFCI circuit breaker for overcurrent protection device serving branch circuit.
- e. Branch Circuit: Provide a 15A/1P circuit breaker for 15 amp rated devices served by a dedicated branch circuit.

4. Manufacturers:

- a. Hubbell WSBUSB2X2
- b. Wiremold DQFPUST
- c. Lew Electric PUFFP-CT-2USB

C. REC-#: Modular Furniture Power System Listed for Furniture Installation.

- 1. 125-volt, 15/20-amp, tamper resistant, 3-wire grounding type with impact resistant thermoplastic face. Three (3) NEMA 5-15R/5-20R, with both simplex devices on same face of assembly. One (1) combination Type A/Type C USB charging rated at 5VDC 3.0A minimum. Integral circuit breaker. First unit includes 10ft plug-and-cord. Daisy-chained units including a 3ft cord between devices. Refer to plans for quantity of devices required. UL 962A Spill/Splash rated. Color selection by architect based on standard factory options.
- 2. Mounting: recessed in surface hardware
- 3. Device(s) installation, orientation, and finish shall be coordinated with Architect/Engineer prior to installation. Provide mockup installation for review and acceptance.

4. Product Specific Coordination:
  - a. The Contractor shall provide provisions as required to maintain the product listing. Refer to the manufacturer's instructions for a complete list of product specific installation requirements.
  - b. Branch Circuit: Provide a 15A/1P circuit breaker for 15 amp rated devices served by a dedicated branch circuit.
5. Manufacturers:
  - a. Legrand Modpower Series

## **2.06 FLOOR BOXES**

- A. Cover Color and Style: Verify with Architect from manufacturer standard options.
- B. Refer to Technology drawings for voice/data, Audio/Video outlet, and coordination requirements.
- C. Floor Boxes Housing Material Based on Cast-in-Place Floor Type:
  1. Slab on Grade: Cast Iron or listed for slab on grade with special kit, coating ,or equivalent; corrosion resistant.
  2. Elevated Slab: stamped steel,
  3. Raised Access Floor, Cast-in-Place, or Access Floor Panels: Stamped steel.
  4. Wood Floor, not Cast-in-Place: Stamped steel and rated for wood floor application.
- D. FB-#: Custom Convention Center Style Utility Box:
  1. Custom Convention Center Style Utility Box, square/rectangular flush-mounted hinged cover, center service area with closed while-in-use cover and cable egress doors in cover, provide complete with appropriate outlet cover plates and hardware. For use with on grade concrete pour floors, 30,000 lbs load capacity, fully adjustable, UL 514 scrub water listed, corrosion resistant housing listed for on-grade applications.
  2. Manufacturers: Hubbell Convention Center Utility Box HBLSCUB Series.
  3. Installation: Group route raceway conduits under slab to nearest wall or as shown on plans. Provide hub reducers when applicable.
- E. FB-#: Concealed Center Compartment:
  1. Floor Box, flush-mounted hinged cover, square/rectangular center service area with closed while-in-use cover and cable egress doors in cover, provide complete with appropriate outlet cover plates and hardware. For use with 4-inch minimum concrete pour floors, fully adjustable, UL 514 scrub water listed.
  2. Gang / Outlet Descriptions:
    - a. 125 Volt, 20 amp, NEMA 5-20R duplex receptacle with 1-inch conduit.
    - b. Voice/Data outlet with 1-1/4-inch conduit. Refer to Technology drawings for additional information.
    - c. Audio/Visual outlet with 1-1/4-inch conduit. Refer to Technology drawings for additional information.
    - d. Spare with 1-1/4-inch conduit.



3. Manufacturers:
  - a. Hubbell CFB Series
  - b. Legrand Wiremold RFB Series
  - c. ABB Steel City 664/665/667 Series
4. Installation: Group route raceway conduits under slab on grade or in ceiling space below to nearest wall or as shown on plans. Provide provisions to core drill elevated floors and route conduits to ceiling space of associated floor box. Provide hub reducers when applicable.

F. FB-#: Concealed Center Compartment (Fire Rated):

1. Floor Box, Fire Rated-2 hours, square/rectangular flush-mounted hinged cover, center service area with closed while-in-use cover and cable egress doors in cover, provide complete with appropriate outlet coverplates and hardware. For use with 3-1/4-inch minimum 5-1/2-inch maximum concrete pour floors, fully adjustable, UL 514 scrub water listed. Provide boxes located in elevated floors with fire rated installation kit.
2. Gang / Outlet Descriptions:
  - a. 125 Volt, 20 amp, NEMA 5-20R duplex receptacle with 1-1/4-inch conduit.
  - b. Voice/Data outlet with 1-1/4-inch conduit. Refer to Technology drawings for additional information.
  - c. Audio/Visual outlet with 1-1/4-inch conduit. Refer to Technology drawings for additional information.
  - d. Spare with 1-1/4-inch conduit.
3. Manufacturers:
  - a. Hubbell CFB Series
  - b. Legrand Wiremold Evolution Series
4. Installation: Group route raceway conduits under slab on grade or in ceiling space below to nearest wall or as shown on plans. Provide provisions to core drill elevated floors and route conduits to ceiling space of associated floor box, UL 514 scrub water listed. Provide hub reducers when applicable.

G. FB-#: Concealed Center Compartment (Access Floor):

1. Floor Box, access floor type, square/rectangular flush-mounted hinged cover, center service area with closed while-in-use cover and cable egress doors in cover, provide complete with appropriate outlet cover plates and hardware, UL 514 scrub water listed. For use in access floors systems 3/4" - 2" thick.
2. Gang / Outlet Descriptions:
  - a. 125 Volt, 20 amp, NEMA 5-20R duplex receptacle with 1-1/4-inch conduit.
  - b. Voice/Data outlet with 1-1/4 -inch conduit. Refer to Technology drawings for additional information.
  - c. Audio/Visual outlet with 1-1/4 -inch conduit. Refer to Technology drawings for additional information.
  - d. Spare with 1-1/4- inch conduit.

3. Manufacturers:
  - a. Hubbell AFB Series
  - b. Legrand Wiremold Evolution Series
  - c. ABB Steel City AFM Series
4. Installation: Group route raceway conduits under finished access floor to nearest wall or as shown on plans. Provide hub reducers when applicable.

H. FB-#: Round Flush with Finished Floor:

1. Floor Box, round, round flush-mounted hinged cover with flange, provide complete with appropriate outlet cover plates and hardware, for use with 4-inch minimum concrete pour floors, fully adjustable.
2. Gang / Outlet Descriptions:
  - a. 125 Volt, 20 amp, NEMA 5-20R duplex receptacle with 3/4-inch conduit.
  - b. Voice/Data outlet with 1-1/4-inch conduit.
  - c. Audio/Visual outlet with 1-1/4-inch conduit.
  - d. Power furniture/equipment feed with flexible whip and 1-inch conduit.
  - e. Voice/Data furniture/equipment feed with flexible whip and 1-inch conduit.
  - f. Audio/Visual furniture/equipment feed with flexible whip and 1-inch conduit.
  - g. Spare with 1- inch conduit.
  - h. Refer to Technology drawings for additional information related to voice/data and audio/visual outlet requirements.
3. Manufacturers:
  - a. Cast:
    - 1) Hubbell 2503 Series
    - 2) Legrand Wiremold 880 Series
    - 3) ABB Steel City 600 Series
  - b. Stamped Steel:
    - 1) Hubbell B2527 Series
    - 2) Legrand Wiremold 880 Series
    - 3) ABB Steel City 68 Series
  - c. Non-Metallic PVC:
    - 1) Hubbell PFB1 Series
    - 2) Legrand Wiremold 880 Series
    - 3) ABB Steel City 68 HP Series
4. Installation: Group route raceway conduits under slab on grade or in elevated slab to nearest wall. Route conduits to nearest wall or as shown on drawings. Provide hub reducers when applicable.

- I. FB-#: Square or Rectangular (Standard):
  1. Floor Box, square or rectangular, square/rectangular flush-mounted hinged cover with flange, provide complete with appropriate outlet cover plates and hardware, for use with 4-inch minimum concrete pour floors, fully adjustable.
  2. Gang / Outlet Descriptions:
    - a. 125 Volt, 20 amp, NEMA 5-20R duplex receptacle with 1-inch conduit.
    - b. Voice/Data outlet with 1-1/4-inch conduit.
    - c. Audio/Visual outlet with 1-1/4-inch conduit.
    - d. Power furniture/equipment feed with flexible whip and 1-inch conduit.
    - e. Voice/Data furniture/equipment feed with flexible whip and 1-inch conduit.
    - f. Audio/Visual furniture/equipment feed with flexible whip and 1-inch conduit.
    - g. Spare with 1- inch conduit.
    - h. Refer to Technology drawings for additional information related to voice/data and audio/visual outlet requirements.
  3. Manufacturers:
    - a. Cast:
      - 1) Hubbell B### Series
      - 2) Legrand Wiremold 880 Series
      - 3) ABB Steel City 640 / 840 Series
    - b. Stamped Steel:
      - 1) Hubbell 242# Series
      - 2) Legrand Wiremold 880 Series
      - 3) ABB Steel City 740 Series
    - c. Non-Metallic PVC:
      - 1) Hubbell
      - 2) Legrand Wiremold 880 Series
      - 3) ABB Steel City 640 Series
  4. Installation: Group route raceway conduits under slab on grade or in elevated slab to nearest wall. Route conduits to nearest wall or as shown on drawings. Provide hub reducers when applicable.

## **2.07 CORD REELS**

- A. CR-#: 50' 3#12 AWG type 'SOW-A' cord with adjustable ball stop. 120 volt, NEMA 5-20R, simplex receptacle connector, rated 16 amps continuous.
  1. Manufacturers:
    - a. Daniel Woodhead 92433
    - b. 9521 w/ Hubbell 5369CY
    - c. Appleton RL153L
    - d. Hubbell HBL HBL45123C20

- B. CR-#: 50' 3#16 AWG type 'SJOW-A' cord with adjustable ball stop. Hand lamp with simplex 120-volt NEMA 5-15R receptacles, rated 6.5 amps.
  - 1. Manufacturers:
    - a. Daniel Woodhead 954
    - b. 106US
    - c. Appleton
    - d. Hubbell HBL50163IN
  
- C. CR-#: 25' 3#16 AWG type 'SJOW-A' cord with adjustable ball stop. Two 120-volt NEMA 5-15R receptacles mounted in cast outlet box, rated 10 amps.
  - 1. Manufacturers:
    - a. Daniel Woodhead 925
    - b. Appleton RL2510
    - c. Hubbell HBLC25163C

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.
  
- B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.
  
- C. Ground Fault Protection: Provide ground fault protection for all branch circuit breakers serving 120/208 receptacles and electrical outlets rated 50 amps or less single-phase and 100 amps or less three-phase in the following locations, as shown on drawings, or required by adopted code:
  - 1. Bathrooms, locker rooms, shower rooms
  - 2. Kitchens' all 120-volt through 250-volt receptacles
  - 3. Buffet, serving, food preparation areas; all 120-volt through 250-volt receptacles
  - 4. Rooftops
  - 5. Interior/Exterior locations subject to damp/wet conditions
  - 6. When located within 6 feet of sinks, bathtubs, and shower stalls
  - 7. Plug-and-cord receptacles when the utilization appliance is located within 6 feet of a sink edge.
  - 8. Aquariums and bait wells
  - 9. Garages, accessory buildings, service bays
  - 10. Accessory dwelling buildings
  - 11. Exterior dwelling outlets (disconnects, equipment connections, etc.) when required by code.
  - 12. Boathouses
  - 13. Specific Appliances: Auto vacuum machines, water drink/bottle fill coolers, pressure staying machines, tire inflation machines, vending machines, sump pumps, dishwashers, electric ranges, ovens, clothes dryers, microwave ovens

14. Horticultural luminaire branch circuits
  15. Future Provisions: Provide a conduit raceway and backbox for the future addition of countertop pop-receptacle when receptacles are not installed in kitchen islands and peninsulas.
- D. Arc-Fault Protection: Provide arc-fault protection for all branch circuit breakers serving the following spaces, or required by adopted code.
1. Dwelling unit living and occupied areas including but not limited to kitchens, family, dining, living, parlors, libraries, dens, bedrooms, sunrooms, recreation, closets, hallways, laundry, and similar spaces.
  2. Dormitory bedrooms, living rooms, hallways, closets, bathrooms, and similar rooms
  3. Guest rooms and guest suites
  4. Sleeping rooms for nursing homes, limited care, and similar non-dwelling living quarters dedicated to sleeping
- E. Tamper Resistant Protection: Provide tamper resistant protection for all 15 / 20-amp 120/208 straight blade wiring devices in the following locations, as shown on the drawings, or required by adopted code.
1. Dwelling units and accessory dwelling unit structures
  2. Boathouses
  3. Dormitory units
  4. Guest rooms, guest suites, and common public areas
  5. Childcare, preschool, elementary, middle, high school, educational facilities
  6. Medical Business Office: Offices, corridors, waiting rooms, common areas
  7. Public Buildings: Corridors, waiting rooms, common areas
  8. Public Spaces involving: Transportation waiting, gymnasiums, fitness centers, auditoriums, public use venue common areas
  9. Nursing homes, assisted living, psychiatric spaces, substance abuse, foster care facilities
  10. Agricultural buildings common areas accessible to the public
- F. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This may include X-ray or similar non-destructive means.
- G. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.
- I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- J. Install devices and wall plates flush and level.
- K. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 26 0553 - Electrical Identification.
- L. Test receptacles and modular wiring connectors for proper polarity, ground continuity and compliance with requirements.

**END OF SECTION**

## SECTION 26 2816 - DISCONNECT SWITCHES

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Fusible switches
- B. Non-fusible switches
- C. Motor disconnect switch
- D. Elevator Service Disconnect Switch

#### 1.02 RELATED SECTIONS AND WORK

- A. Refer to the Disconnect and Starter Schedule for rating and configuration.

#### 1.03 REFERENCES

- A. NEMA KS 1 - Enclosed Switches

#### 1.04 SUBMITTALS

- A. Submit product data under provisions of Section 26 0500.
- B. Product Data: For each type of enclosed switch, circuit breakers, accessory and component indicated, include dimensions, weights, and manufacturer's technical data on features, performance, and ratings.
- C. Electrical Characteristics: For each type of enclosed switch, enclosure types, current and voltage ratings, short-circuit current ratings, UL listing for series rating of installed devices, features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

#### 1.05 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

### PART 2 - PRODUCTS

#### 2.01 FUSIBLE AND NON-FUSIBLE SWITCHES

- A. Acceptable Manufacturers:
  - 1. Square D 3110 Series
  - 2. Eaton DH Series
  - 3. ABB TH Series

4. Siemens HNF / HF Series

- B. FDS-#; Fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position. Fuse Clips: Class 'R' fuse clips only, unless indicated otherwise on the drawings.
- C. DS-#; Non-fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position.
- D. Enclosures: Type as indicated on the disconnect schedule.
- E. Accessories: As indicated on the Disconnect Schedule. Provide the following accessories for each application.
  - 1. Lockable
  - 2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

**2.02 MOTOR DISCONNECT SWITCH**

- A. Acceptable Manufacturers:
  - 1. Square D 3110 Series
  - 2. Eaton r5 Series
  - 3. ABB ML Series
  - 4. Siemens LBR Series
- B. Enclosures: Type as indicated on the Disconnect Schedule.
- C. Ground lug connection provided in enclosure.
- D. Accessories: As indicated on the Disconnect Schedule. Provide the following accessories for each application.
  - 1. Lockable
  - 2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.
- E. Listed UL 508 suitable for motor control.

**2.03 ELEVATOR SERVICE DISCONNECT SWITCH**

- A. Acceptable Manufacturers:
  - 1. Eaton Bussmann PS Series
  - 2. Mersen ES Series
  - 3. Littlefuse LPS Series



- B. Elevator Service Fused Disconnect Switch: Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool, with lockable handle, ratings per drawing schedule, 120 volt shut trip, two field convertible mechanically interlocked form C auxiliary contacts, shunt trip voltage monitor relay, integral control transformer, Pilot Light "on", neutral bar/lug, NEMA 1 enclosure, minimum 100K SCCR, UL Listed.
- C. Provide with fire alarm interface relays for:
  - 1. Elevator Recall
  - 2. Elevator Alternative Floor Recall
  - 3. Elevator Shut Down Sequence
  - 4. Fire Fighter's Cab Visual Alarm
  - 5. Elevator Hoistway Damper
- D. Accessories: Provide the following accessories for each application.
  - 1. Lockable
  - 2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install disconnect switches where indicated on the drawings.
- B. Install fuses in fusible disconnect switches.
- C. Field coordinate installation with other contractors and equipment to maintain code required working space requirements.
- D. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

#### **3.02 ELEVATOR SERVICE DISCONNECT SWITCH**

- A. Coordinate installation with elevator requirements and contractor.
- B. Coordinate installation with fire alarm contractor.

#### **3.03 MOBILE DIAGNOSTICS SERVICE DISCONNECT**

- A. Coordinate installation with mobile medical equipment requirements and vendor.

#### **3.04 ADJUSTING**

- A. Set field-adjustable circuit breaker trip ranges.

**END OF SECTION**

## **SECTION 26 3213 - PACKAGED ENGINE GENERATOR SYSTEMS**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Packaged engine generator system
- B. Heat exchanger
- C. Battery and charger
- D. Weatherproof enclosure
- E. Radiator mounted load bank

#### **1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION**

- A. Section 22 1023 - Natural Gas and Propane Piping
- B. Section 22 3000 - Plumbing Equipment
- C. Section 23 2100 - Hydronic Piping
- D. Section 23 5700 - Heat Exchangers

#### **1.03 REFERENCES**

- A. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- B. ANSI/NEMA AB 1 - Molded Case Circuit Breakers
- C. ANSI/NEMA MG 1 - Motors and Generators
- D. NFPA 37 - Installation and Use of Stationary Combustion Engines and Gas Turbines
- E. NFPA 70 - National Electrical Code (NEC)
- F. NFPA 99 - Standard for Health Care Facilities
- G. NFPA 110 - Standard for Emergency and Standby Power Systems
- H. IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- I. Environmental Protection Agency EPA Emission Standards for Compressed Ignition Engines
- J. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at property boundaries due to sound emitted by the generator set, its components and the operation thereof.

#### **1.04 SUBMITTALS**

- A. Submit shop drawings and product data under provisions of Section 26 0500.
- B. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.
- C. Submit product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank, remote radiator, and remote annunciator.
  - 1. Include work clearance and equipment access information. Clearly identify required equipment access locations for installation, maintenance, testing, and repair.
- D. Submit certificates for compliance with EPA Emissions Standards for Compressed Ignition Engines.
- E. Submit manufacturer's installation instructions under provisions of Section 26 0500.
- F. Submit complete control and operation sequences for on-board paralleling system.
- G. Submit load study indicating the voltage drop under starting condition for the fire pumps will not exceed 15%. Fire pump shall be the last step on the generator.

#### **1.05 EXTRA MATERIALS**

- A. Submit maintenance materials under provisions of Section 26 0500.
- B. Furnish one set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal toolbox.
- C. Provide two additional sets of each fuel, oil, and air filter element required for the engine generator system. Provide additional fuel polishing filters for one year of operation.
- D. Provide one fuse for every type and rating used.
- E. Provide five (5) extra DC incandescent lamps and five (5) compact fluorescent lamps.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site under provisions of Section 26 0500.
- B. Store and protect products under provisions of Section 26 0500.
- C. Accept packaged engine generator set and accessories on site in crates and verify damage.
- D. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

#### **1.07 SYSTEM DESCRIPTION**

- A. Engine generator system to provide source of emergency and standby power.

- B. Emergency Power Supply System (EPSS) shall be NFPA 110 Type 10 Class 2 Level 2.
- C. Operation: In accordance with ANSI/NFPA 110.

#### **1.08 COORDINATION DRAWINGS**

- A. Reference Coordination Drawings article in Section 26 0500 for required generator electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings. Show generator, fuel system components, battery system components, and exhaust system in 1/4" scale plan of room.

#### **1.09 PROJECT RECORD DOCUMENTS**

- A. Submit record documents under provisions of Section 26 0500.
- B. Accurately record location of engine generator and mechanical and electrical connections.

#### **1.10 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data under provisions of Section 26 0500.
- B. Include instructions for normal operation, routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

#### **1.11 QUALIFICATIONS**

- A. Manufacturer: Company specializing in packaged engine generator system with minimum five (5) years documented experience.
- B. Manufacturer: Company with minimum five (5) years of documented on-board paralleling system experience.
- C. Supplier: Authorized distributor of engine generator manufacturer with service facilities within 50 miles of the project site.

#### **1.12 WARRANTY**

- A. Provide a five (5) year warranty under provisions of Section 26 0500.

#### **1.13 MAINTENANCE SERVICE**

- A. Furnish service and maintenance of packaged engine generator system for one (1) year from Date of Substantial Completion. Maintenance service shall be performed by skilled employees of manufacturer's designated service organization. Include quarterly exercising, and routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts, supplies, and labor.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Caterpillar.
- B. Cummins Power Generation.
- C. Kohler.
- D. MTU On Site Energy.

### **2.02 PACKAGED ENGINE-GENERATOR SET**

- A. Packaged engine-generator set shall be a coordinated assembly of compatible components. Stationary generators shall be listed.
- B. Safety Standard: Comply with ASME B15.1 and UL 2200.
- C. Nameplates: Each major system component shall be equipped with a nameplate to identify manufacturer's name and address, model and serial number, and component rating in integrated set and as required by the contract documents.
- D. Fabricate engine-generator set mounting frame and attachment of components to resist generator-set movement during a seismic event when generator-set mounting frame is anchored to building structure.
- E. Mounting Frame: Adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners and shall have lifting attachments arranged for lifting with slings without damaging components. Provide a rigging diagram permanently attached to the mounting frame to indicate the capacity of each lifting attachment and the generator-set center of gravity.

### **2.03 ENGINE**

- A. Type: Water-cooled in-line or V-type, ignition diesel electric ignition internal combustion engine.
- B. Rating: Sufficient to operate at 100 percent load for two hours at specified elevation and ambient limits.
- C. Governor: Isochronous type with speed sensing.
- D. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.
- E. Frequency Response:
  - 1. Steady State Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
  - 2. Transient Response: Less than 5 percent for a 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady state operating band within 5 seconds.

- F. Fuel System:
- G. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90°F, and suitable for operation on 120 208-1Ø volts AC. The minimum wattage of the heater shall be watts or as recommended by the manufacturer.
- H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator set mounting frame and integral engine-driven coolant pump.
  - 1. GRR-; Remote Radiator: Vertical air discharge. Multiple belt drive from totally enclosed sealed bearing motor. Sized by generator manufacturer.
  - 2. Fan and Core: Nonferrous-metal construction sized to contain expansion of total system. Blower type fan, sized to maintain safe engine temperature in ambient temperature of 110°F. Radiator Airflow Restriction: 0.5 inches of water, maximum.
  - 3. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anti-corrosive additives.
  - 4. Provide expansion tank with gage glass and petcock, and self-contained, thermostatic-control temperature control valve.
- I. The packaged engine generator shall comply with the current Environmental Protection Agency EPA Emissions standards.
- J. Engine Accessories: Fuel filter, lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Include fuel pressure gauge, water temperature gauge, and lube oil pressure gauge on engine-generator control panel.
- K. Mounting: Provide unit with suitable spring-type vibration isolators.

## **2.04 GENERATOR**

- A. Generator: ANSI/NEMA MG 1; three phase, re-connectible brushless synchronous generator with brushless exciter and PMG alternator excitation.
- B. Rating: As indicated on the drawings, at 0.8 power factor, 60 Hertz at RPM to match engine rating.
- C. Insulation: ANSI/NEMA MG 1, Class F.
- D. Temperature Rise: 105°C continuous.
- E. Enclosure: ANSI/NEMA MG 1; open drip-proof.
- F. Voltage Regulation:
  - 1. The maximum instantaneous voltage dip (IVD) shall be 28 percent for building loads and 15 percent for the fire pump.
  - 2. Include solid-state type voltage regulator, separate from exciter to match engine and generator characteristics, with voltage regulation  $\pm 1$  percent from no load to full load. Include manual controls to adjust voltage drop  $\pm 5$  percent voltage level, and voltage gain.
- G. Subtransient Reactance (X'd): Maximum 15 percent.

- H. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

## **2.05 CONTROLS AND INDICATION**

- A. Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
- B. Ground Fault: Provide ground fault sensing at the generator. The sensor shall be located ahead of the generator service disconnect. Provide a ground fault indication on the engine-generator control panel. Provide an instruction nameplate at the control panel.
  - 1. Instruction nameplate: Provide operational instructions for a ground fault indication as approved by the local Authority Having Jurisdiction.
- C. GCP-; Engine-Generator Control Panel: ANSI/NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include provision for padlock and the following equipment and features:
  - 1. Alarm indication as required by NFPA 110 for a Level 2 system.
  - 2. AC frequency meter.
  - 3. AC output voltmeter with phase selector switch.
  - 4. AC output ammeter with phase selector switch.
  - 5. Output voltage adjustment.
  - 6. DC voltmeter (alternator battery charging).
  - 7. Engine start/stop selector switch.
  - 8. Engine running time meter.
  - 9. Oil pressure gauge.
  - 10. Engine coolant temperature gauge.
  - 11. Shut down devices for overspeed, coolant high-temperature, coolant low-level, and oil low-pressure.
  - 12. Fuel derangement alarm.
  - 13. Generator overload.
  - 14. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
  - 15. Remote Alarm Contacts: Pre-wire SPST contacts to terminal strip for remote alarm functions required by ANSI/NFPA 99.
  - 16. Ground fault indication.
  - 17. Generator control and start signal failure.
- D. GANN-; Remote Engine Annunciator Panel: ANSI/NFPA 99 and NFPA 110 for a Level 2 system. Include the listed pre-alarm and alarm points, audible alarm, alarm silencing means, repetitive alarm circuitry, and lamp test switch in a surface mounted panel with brushed stainless steel finish. Provide all interconnecting wiring in conduit per manufacturer's requirements by the Electrical Contractor. The remotely reported alarms shall include the following.
  - 1. Overcrank
  - 2. Low water (engine) temperature
  - 3. High engine temperature pre-alarm

4. High engine temperature
  5. Low lube oil pressure pre-alarm
  6. Low lube oil pressure
  7. Overspeed
  8. Low fuel main tank
  9. Low coolant level
  10. Not in auto
  11. Emergency Power Supply (EPS) supplying load
  12. High battery voltage
  13. Low battery voltage
  14. Battery charger failure (includes AC failure)
  15. Generator running
  16. Normal utility power
  17. Emergency stop
  18. Rupture basin alarm
  19. Emergency Power Off Switch activated (EPO)
  20. Alarm for power supply or UPS serving motorized breakers
  21. Generator control and start signal failure.
  22. On-board paralleling controls.
  23. 80% load alarm.
- E. Remote Engine Manual Start Control: Two-wire remote start control from fire command center. Provide all interconnecting wiring in conduit per manufacturer's requirements (by the Electrical Contractor).
- F. Building Automation System Integration:
1. Provide a terminal block to allow the Facility Monitoring and Control System (FMCS) to report generator alarms. Provide individual terminal points for each of the annunciator alarms and pre-alarms. Provide an additional terminal point to combine all generator alarms under a single terminal point. Provide a permanent label for each terminal point. Each terminal will provide a binary output for the FMCS to read. Refer to Section 23 0900 for alarms reported by the FMCS.

## **2.06 RADIATOR MOUNTED LOAD BANK**

- A. The generator load bank shall be a completely self-contained unit that includes all resistive load elements, load control devices, load element branch circuit fuse protection, terminal, system protection devices and NEMA enclosure.
- B. System protection shall include protection against overheating by disconnecting the load elements and activating an alarm. Load element control shall be a magnetic contactor with fuses. A remote load dump circuit shall remove the load bank upon opening of a contact in the automatic transfer switches.
- C. Control power shall be derived internally from the main load bus. Control and protective circuits shall operate at 120 volt via a control power transformer and shall be fused.
- D. The load bank shall be installed within the air outlet of the engine unit-mounted radiator. Coordinate mounting with ventilation contractor.
- E. The control section shall be thermally isolated from the load elements and airflow. Load bank power and control wiring shall be 150°C XLP insulated.



F. Load Bank Rating:

1. Capacity: 50 KW, 1.0 power factor.
2. Load Steps: 25 KW maximum per step.
3. Voltage: 208 volts.
4. Load Bank Controls:
  - a. Manual controls including:
    - 1) Power ON/OFF switch
    - 2) Master load ON/Off switch
    - 3) Load step control switches
    - 4) Over-temperature alarm indicator.

G. Load Bank Wiring:

1. Contractor shall wire load bank power and controls. Wire remote load dump control to all automatic transfer switches connected to generator distribution.
  - a. Manufacturers:
    - 1) Simplex, Inc.
    - 2) LBD series
    - 3) Avtron Loadbank, Inc. K711 series.

**2.07 OUTDOOR GENERATOR-SET ENCLOSURE SKIN-TIGHT**

A. Prefabricated or pre-engineered skintight enclosure with the following features:

1. Construction: Reinforced galvanized steel, metal clad, integral structural steel framed housing anchored to a concrete foundation. Panelized aluminum housing with integral structural framing anchored to a concrete foundation. Construction shall allow access to control panels and service points. The panels shall enclose all components, including intake/exhaust louvers and sound attenuators. Extend the enclosure base frame as required for panels.
2. The generator control panel shall be located no greater than 5'-0" above finished grade for ease of access.
3. Structural Design and Anchorage: Wind resistant up to 100 mph.
4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents. Motor operators shall be spring open, power close operating at 24 volts DC. The louvers shall be connected to the generator starting batteries through appropriate control relays. Louvers shall not extend outside main generator enclosure.
5. Hinged Doors: Provide a minimum of four doors with padlocking provisions. Single doors shall be 36" wide and 84" high. Double doors shall be 60" wide and 84" high. As standard, doors shall include rain-rail moldings above all door openings, recessed, keyed mortise locks, panic bar door hardware and full weather-stripping. Doors shall be removable.
6. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits as required by engine-generator-set components.
7. Fuel Tank Vent: Provide vent piping from the fuel tank to the exterior of the enclosure.

8. Fuel Fill: Provide fill access on the exterior of the enclosure at an elevation not to exceed 5'-0" above finished grade.
9. The exhaust system silencer shall be installed within the enclosure housing.

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that surfaces are ready to receive work and field dimensions are as shown on the drawings.
- B. Verify that required utilities are available in proper location and ready for use.
- C. Beginning of installation means installer accepts existing conditions.

#### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install remote manual stop station in location shown on plans. Provide 120 Volt power and wiring in conduit as required. Coordinate installation with the manufacturer approved shop drawings and wiring diagrams. The remote manual stop station shall shunt trip the generator mounted circuit breaker.
- C. The A-B-C phase rotation of the generator source shall match the A-B-C phase rotation of the utility source. The Contractor shall verify the generator and utility phase rotation match to prevent three phase motors and similar loads from operating backwards while being served by the generator.

#### **3.03 COMMISSIONING: ON-BOARD GENERATOR PARALLELING CONTROL**

- A. Prepare, start, test, and adjust systems under provisions of Section 26 0500. The on-board paralleling startup, testing, and commissioning may be conducted with other startup, testing, and commissioning requirements of this specification.
- B. Provide on-site manufacturer representative for on-board generator paralleling system startup, testing, and commissioning.
- C. Simulate a utility power loss test of the EPSS and on-board generator paralleling control system.
  1. Refer to the emergency power system sequence of operation schedule on the drawings.
  2. Report and document deviations from the sequence of operation schedule, system adjustments, and deficiencies.
  3. Obtain and Submit Authority Having Jurisdiction AHJ observation and certificate of acceptable emergency power system operation when required for facility occupancy certificate.
  4. ADJUSTING
- D. Adjust generator output voltage and engine speed.

**3.04 CLEANING**

- A. Clean work under provisions of Section 26 0500.
- B. Clean engine and generator surfaces. Replace oil and fuel filters.

**END OF SECTION**

## SECTION 26 3600 - TRANSFER SWITCH

### PART 1 - GENERAL

#### 1.01 RELATED SECTIONS AND WORK

- A. Refer to the Transfer Switch Schedule for rating and configuration.

#### 1.02 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in automatic transfer equipment with three (3) years documented experience.

#### 1.03 REFERENCES

- A. NEMA ICS 1 - General Standards for Industrial Control and Systems
- B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies
- C. NEMA ICS 6 - Enclosures for Industrial Controls and Systems
- D. NEMA ICS 10 - Guide to Application of Low-Voltage Automatic Transfer Switch Equipment
- E. UL 1008 - Standard for Automatic Transfer Switches
- F. NFPA 99 - Health Care Code
- G. NFPA 110 - Standard for Emergency and Standby Power Systems

#### 1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable code for emergency and standby electrical systems.

### PART 2 - EXECUTION

#### 2.01 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field measurements are as instructed by the manufacturer.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means acceptance of existing conditions.

#### 2.02 CONTROL AND SIGNAL CABLING

- A. Provide control and signal cabling per manufacturer recommendations for the following systems components:

1. Remote annunciator.
2. Elevator controller. Provide wiring to elevator controller for emergency source mode and emergency to normal pre-signal.
3. Generator start signal. The generator start signal cabling for the following transfer switches shall be fire protected for a minimum of 2 hours using an approved method:
  - a. Fire pump transfer switch
  - b. Emergency, legally required, optional standby transfer switches
  - c.
  - d. Approved Methods:
    - 1) Raceway or cable encased in a minimum of 2 inches of concrete cover.
    - 2) Listed fire resistive raceway / cable system.
    - 3) Raceway / cable is protected by a listed electrical circuit protective system.

### **2.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.

**END OF SECTION**

## SECTION 26 5119 - LED LIGHTING

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Interior luminaires and accessories
- B. Exterior luminaires and accessories
- C. LED emergency lighting units
- D. Emergency exit signs
- E. Lighting poles

#### 1.02 RELATED SECTIONS

- A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:
  - 1. 26 09 33 Lighting Control Systems
    - a. Automatic load control relay (ALCR) (individual luminaire - integral) (ALCR3)
  - 2. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

#### 1.03 REFERENCES

- A. ANSI C78.377 - Specifications for the Chromaticity of Solid State Lighting Products
- B. ANSI C82.16 - Light-Emitting Diode Drivers - Method of Measurement
- C. ANSI C82.77 - Standard for Harmonic Emission Limits and Related Power Quality Requirements for Lighting Equipment
- D. NFPA 70E - National Electrical Safety Code
- E. NEMA SSL1 - Electronic Drivers for LED Devices, Arrays or System
- F. UL 8750 - Light Emitting Diode (LED) Equipment for use in Lighting Products
- G. LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

- H. LM-80 - Measuring Luminous Flux and Color Maintenance of LED
- I. FS W-L-305 - Light Set, General Illumination (Emergency or Auxiliary)
- J. UL 924 - Standard for Emergency Lighting and Power Equipment
- K. UL676 Standard for Underwater Luminaires and Submersible Junction Box

#### **1.04 SUBMITTALS**

- A. Submit product data under provisions of Section 26 0500.
- B. Basic Requirements of Submittal:
  - 1. Submit product data sheets for luminaires, LED light engines, drivers and poles. Include complete product model number with all options as specified. Submittal shall be arranged with luminaires listed in ascending order, and with each luminaire's, LED light engine, driver, or pole information following luminaire's product data. Failure to organize submittal in this manner will result in the submittal being rejected.
  - 2. Submit lens product data, dimensions and weights if not included in product data sheet submittal.
  - 3. Include outline drawings, support points, weights, and accessory information for each luminaire.
  - 4. Submit manufacturer origin of LED chipset and driver.
- C. LED Lighting - Performance Testing Submittal (when requested by Architect/Engineer):
  - 1. IESNA LM-79: Include photometric report for the latest generation system being furnished. Provide name of independent testing laboratory, report number, date of test, luminaire series/model number, input wattage, and light source specifications.
  - 2. IESNA LM-80: Measuring Lumen Maintenance of LED Light Sources.
- D. LED Lighting - Control Compatibility Submittal:
  - 1. Submit lighting control capability data for each LED luminaire. The submittal shall clearly identify device data proposed by the Contractor and approved by the luminaire manufacturer for dimming, switching, addressable, wireless, and similar control characteristics.
- E. Submit Design Lights Consortium (DLC) information for each luminaire type.
- F. Submit utility rebate forms where offered at project location. Submit completed rebate forms within 30 days of Substantial Completion.

#### **1.05 EXTRA STOCK**

- A. Provide extra stock under provisions of Section 26 0500.
- B. LED Light Engines or Modules: 5 percent of quantity installed, minimum one (1) of each size and type of field replaceable light engine or module. Provide field replacement installation instructions.
- C. Lenses: Three (3) percent of quantity installed, minimum one (1) of each size and type.

- D. LED Drivers: 3 percent of quantity installed, minimum one (1) of each size and type.
- E. Exit Signs: Provide 5 additional exit sign luminaires complete with labor, conduit, and wire. Additional exit luminaires shall be located per the Architect/Engineer or provided as attic stock when a location is not defined prior to Owner occupancy. When multiple exit signs are scheduled, the quantity listed above shall represent each type listed.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site. Store and protect under provisions of Section 26 0500.
- B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.
- C. Handle site lighting poles carefully to prevent breakage and damage to finish.

**1.07 MOCKUP**

- A. Provide and install luminaires with power and control connections in mockup rooms as identified in Division 1. Approved luminaires in mockup may be reused as part of complete work if in original condition.

**1.08 WARRANTY**

- A. The warranty period begins at the date of Substantial Completion.
- B. LED Light Engines and Drivers:
  - 1. LED Drivers and Dimming Drivers: Five (5) years
  - 2. Light Emitting Diode (LED) Light Engines: Five (5) years
- C. Emergency Lighting Units and Exit Signs:
  - 1. Emergency Lighting Units: Three (3) year, non-prorated
  - 2. Exit Signs: Three (3) year, non-prorated
  - 3. Emergency Unit and Exit Sign Battery: Sealed lead acid or lead calcium cell, requiring no maintenance or replacement for ten (10) years under normal conditions.
- D. Emergency Drivers:
  - 1. Emergency LED Driver: Three (3) years
- E. Pole Finish: Three (3) year warranty of pole color and finish

**1.09 REGULATORY REQUIREMENTS**

- A. Conform to NFPA 101 for installation requirements



## **PART 2 - PRODUCTS**

### **2.01 INTERIOR LUMINAIRES AND ACCESSORIES - GENERAL**

- A. Lensed Troffers: Provide hinged frames with latches and 0.125-inch thick virgin acrylic lenses. Prismatic lenses shall have depth of no less than 0.080", KSH12 or equal. Other lenses as scheduled.
- B. Recessed Luminaires: Confirm ceiling and wall type and furnish trim and accessories necessary to permit proper installation in each system. Where fire-rated ceiling or wall assemblies are specified, furnish and install listed enclosures around luminaires that maintain the system rating.
- C. Luminaires: Louvers shall be anodized low iridescent specular aluminum with mitered corners and interlocking construction.
- D. Suspended Luminaires: Coordinate power feed and suspension canopies with ceiling type and architectural RCP for proper fit and location. Ensure finished installations are plumb and level at elevations specified. Verify suspension length prior to submittal.
- E. Painted reflector surfaces shall have a minimum reflectance of 90%.
- F. All painted components shall be painted after fabrication.

### **2.02 EXTERIOR LUMINAIRES AND ACCESSORIES - GENERAL**

- A. Listed for wet or damp location as scheduled. Provide ingress protection (IP) rating when scheduled.
- B. Provide low temperature LED drivers, with reliable starting to -20°F.
- C. In-grade luminaires shall have lamp/optic separation to prevent surface temperature from exceeding 115°F. Compartment separation of wire entry and control gear/lamp chamber.
- D. Exterior LED luminaires shall contain separate, easily accessible and replaceable Category C surge protection device.

### **2.03 EMERGENCY EXIT SIGNS**

- A. Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings.
- B. Directional Indicators: The directional indicator for exit signage shall be of a chevron type meeting all requirements of NFPA 101.
- C. Self-Diagnostics and Testing:
  - 1. Unit shall be self-diagnostic with continuous monitoring of charger performance and battery voltage. Any malfunction of battery, charger, transfer circuit, or emergency lamps shall be detected and visually indicated.

2. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five minute discharge/diagnostic test at any time.

## **2.04 LIGHTING POLES**

- A. Manufacturers:
  1. Manufacturer of luminaire (metallic pole)
  2. Valmont Poles (metallic pole)
  3. U.S. Pole Company (metallic pole)
  4. KW Industries (metallic pole)
- B. Metal Poles: Round lighting pole with anchor base.
  1. Painted steel poles shall have electrostatic applied polyester powder coated paint finish thermally cured with UV protection. Interior of pole shall be coated with same coating for a minimum of 12" from base plate.
  2. Galvanized steel hot dipped finish to standard AASHTO M 111.
  3. Anodized aluminum finish to MIL-A-8625 Type II, minimum 0.8 mil thickness. Provide anodized color sample to Architect/Engineer prior to ordering.
- C. Wind Load: 100 MPH velocity, with 1.14 percent three-second gust factor with luminaires and brackets mounted.
- D. Hand Hole: 2 x 4 inches with removable weatherproof cover installed at manufacturer's standard location. Provide matching gasketed cover plate.
- E. Pole Top: Provide Insert inch diameter slipfitter.
- F. Anchor Bolts: As recommended by pole manufacturer. Provide template, flat washers, lock washers, and hex nuts for each pole. Grout between anchor plate and concrete base with non-shrink grout after pole is plumbed.
- G. Vibration Damper: Canister or snake type second mode vibration damper internal to the metal pole as recommended by pole manufacturer. Provide additional pole top damper for first mode vibration on single-head metal poles where recommended by manufacturer.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Securely fasten luminaires to the listed and labeled ceiling framing member by mechanical means such as bolts, screws, rivets or listed clips identified for use with the type of ceiling framing members. The architectural ceiling framing system may be used in lieu of independent support with prior written approval by the ceiling system manufacturer and Authority Having Jurisdiction (AHJ). Luminaires and wiring installed in fire-rated ceiling assemblies shall be independently supported for all applications.
  1. Install recessed flanged luminaires to permit removal from below. Use manufacturer-supplied plaster frames and swing gate supports. Provide independent support as follows:

- a. Luminaires less than 56 lbs: Provide a minimum of two (2) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires.
  - b. Luminaires 56 lbs or greater: Provide a minimum of four (4) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires. Support luminaire independent of the ceiling system.
  - c. Luminaires larger than eight square feet (8 ft<sup>2</sup>): Support luminaire independent of the ceiling system.
- B. Do not fasten luminaire supports to piping, ductwork, mechanical equipment, or conduit, unless otherwise noted. Support wires shall be tightly wrapped (minimum of three turns within 3 inches of the connection) and sharply bend to prevent vertical movement.
  - C. Support suspended or pendant mounted luminaires independent of ceiling grid with adjustable stainless steel aircraft cables or per luminaire schedule mounting requirements. Suspension assembly and anchors shall be capable of supporting 300 pounds dead load at each suspension point.
  - D. Support wire used to independently support luminaires, raceways, and wiring systems shall be distinguishable from ceiling support systems by color (field paint), tagging or equivalent means.
  - E. Adjust aimable luminaires to obtain lighting levels on objects and areas as directed to obtain desired lighting levels.
  - F. Recessed luminaires and other optical accessories shall remain in protective wraps or films until construction in area is complete and area has been cleaned.
  - G. Industrial Pendant Luminaires: Use power hook hangers rated 500 pounds minimum or provide safety chain between driver and structure. Provide safety chain between reflector and driver.
  - H. Luminaire Pole Bases: Sized and constructed as indicated on the drawings. Project anchor bolts 2 inches minimum above base. Install poles plumb with double nuts for adjustment. Grout around pole anchor base.
  - I. Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.

### **3.02 CONSTRUCTION USE OF PROJECT LUMINAIRES**

- A. The Contractor shall provide temporary construction lighting per the requirements of Division 1.
- B. The project luminaires shown on the construction documents shall not be used for temporary construction purposes without providing a plan for Owner approval that addresses energy and luminaire operating hours.

### **3.03 EMERGENCY LIGHTING UNITS AND EXIT SIGNS**

- A. Install units plumb and level.
- B. Aim directional lamp heads as directed.
- C. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

**3.04 RELAMPING**

- A. Replace failed LED light engine modules or arrays at completion of work.

**3.05 ADJUSTING AND CLEANING**

- A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Touch up luminaire and pole finish at completion of work.

**3.06 OWNER TRAINING**

- A. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion, with the Owner's Representative.
- B. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

**3.07 LUMINAIRE SCHEDULE**

- A. As shown on the drawings.

**END OF SECTION**

**SECTION 28 3113  
FIRE ALARM SYSTEM**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.
- B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications. Separate fire alarm systems shall be provided for the Lab and the Fire Pump House.
- C. The Fire Alarm Systems shall consist of all necessary hardware equipment and software programming to perform the following functions:
  - 1. Fire alarm and detection operations.
  - 2. Control and monitoring of fire suppression systems and other equipment as indicated in the drawings and specifications.

**1.03 QUALIFICATIONS**

- A. The contractor shall employ factory trained and NICET certified technicians.
- B. The manufacturer and contractor shall have a minimum of 5 years' experience in the fire protective signaling systems industry.

**1.04 SYSTEM DESCRIPTION**

- A. General: Provide a complete, addressable, microprocessor-based, networkable fire alarm system with initiating devices, notification appliances, monitoring devices, and control devices, as indicated on the drawings and as specified herein.
- B. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory.
- C. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history.
- D. Recording of Events: Record all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identifications, date, and time of the occurrence. The printout differentiates alarm signals from all other printed indications.
- E. Wiring/Signal Transmission:
  - 1. Transmission shall be hard-wired, using separate individual circuits for each zone of alarm operation as required for addressable signal transmission, dedicated to fire alarm service only.
  - 2. System connections shall be:
    - a. For Initiating Device Circuits, Class B.
    - b. For Signaling Line Circuits, Class B.
    - c. For Notification Appliance Circuits, Class B.
  - 3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.
- F. Required Functions: The following are required system functions and operating features:

1. Priority of Signals: Alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
2. Non-interfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent activations.
3. Transmission to Remote Central Station: Automatically route point identification to a remote central station service transmitter provided under another contract.
4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator, indicating the location and type of device.
5. General Alarm and Waterflow Alarm: A system general or waterflow alarm shall include:
  - a. Indication of alarm condition at the FACP and the annunciator(s).
  - b. Identification of the device that is the source of the alarm at the FACP and the annunciator(s).
  - c. Operation of audible notification devices throughout the building until silenced at FACP.
  - d. Operation of audible and visible notification devices throughout the building until silenced at FACP.
  - e. Transmit an alarm to the central receiving station.
6. Supervisory Operations:
  - a. Upon activation of a supervisory device such as duct smoke detection, high/low air pressure and tamper switch, the system shall operate as follows: system supervisory service audible signal and illuminate the LED at the control unit and the graphic annunciator.
  - b. Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
  - c. Record the event in the FACP historical log and on a system printer.
  - d. Transmission of supervisory signal to remote central station.
  - e. Restoring the condition shall cause the Supervisory LED restore system to normal.
7. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible and visible alarm signals shall cease operation.
8. System Reset:
  - a. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps (e.g.; "IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarmed the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
  - b. Should an alarm condition continue, the system will remain in an alarmed state.
9. Drill: A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.
10. WALK TEST: The system shall have the capacity of eight programmable passcode protected one-person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one-person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:

- a. Control relay functions associated to one of the eight testing groups shall be bypassed.
  - b. The control unit shall indicate a trouble condition.
  - c. The alarm activation of any initiation device in the testing group shall cause the audible notification appliances to sound a code to identify the device.
  - d. The unit shall automatically reset itself after signaling is complete.
  - e. Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.
11. Addressable Smoke Sensors:
- a. Monitoring FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
  - b. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
  - c. Programmable Sensitivity: Photoelectric Smoke Sensors shall have seven sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
  - d. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements.
  - e. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to indicate that a sensor requires cleaning. When a sensor's average value reaches a predetermined value, three progressive levels of reporting are provided. The first level shall indicate that a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a dirty sensor without creating a trouble in the system. If this indicator is ignored, a second level "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported to the Central Monitoring Station. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.
  - f. The FACP shall continuously perform an automatic self-test on each sensor which will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
  - g. Audible Alarm Notification: By horn/strobes and strobes in areas as indicated on drawings.
12. Power Requirements:
13. The control unit shall receive 120 VAC power via a dedicated fused disconnect circuit.
- a. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of 24 hours with 5 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
  - b. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.
  - c. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously while incoming power is present.

- d. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be indicated at the control unit.
- e. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
- f. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

## 1.05 SUBMITTALS

- A. General: Submit the following:
  - 1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification.
  - 2. Wiring diagrams from manufacturer.
  - 3. Shop drawings showing system details including location of FACP, all devices, circuiting and details of graphic annunciator. Voltage drop calculations shall be included to verify achievement of minimum sound levels specified by NFPA 72.
  - 4. System power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
  - 5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, SLC, NAC, relay, sensor, and auxiliary control circuits.
  - 6. Operating instructions for FACP.
  - 7. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type of product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
  - 8. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
  - 9. Record of field tests of system.
- B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the Authority Having Jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions if required to make clarifications or revisions to obtain approval.

## 1.06 QUALITY ASSURANCE

- A. Each and all items of the Fire Alarm Systems shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

## PART 2 - PRODUCTS

### 2.01 FIRE ALARM CONTROL PANEL (FACP)

- A. General: Comply with UL 864, 9th edition, "Control Units for Fire-Protective Signaling Systems."
- B. The following FACP hardware shall be provided:
  - 1. Base panel with cabinet and door, 120 VAC input power.
  - 2. 100 minimum addressable point capacity (inputs or outputs).
  - 3. Four CPU controlled Auxiliary Control Relays, DPDT contacts rated for 2A @ 24 VDC or ½ A @ 120 VAC, inductive10A @ 24 VDC or 240 VAC, inductive3A @ 24 VDC or 120 VAC, resistive.
  - 4. Provide battery voltage and ammeter readouts from the LCD Display.



5. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators, transponders, and I/O panels.
  6. Point Identification DACT.
- C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.
  - D. Alphanumeric Display and System Controls: Panel shall include a minimum 80-character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.
  - E. Distributed Module Operation: FACP shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Style 4 Class B supervised serial communications channel:
    1. Addressable Signaling Line Circuits
    2. Initiating Device Circuits
    3. Notification Appliance Circuits
    4. Auxiliary Control Circuits

## **2.02 ADDRESSABLE MANUAL PULL STATIONS**

- A. Description: Addressable double-action type, red LEXAN or metal, and finished in red with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

## **2.03 SMOKE SENSORS**

- A. Type: Spot-type, photoelectric.

## **2.04 ALARM NOTIFICATION APPLIANCES**

- A. Notification Appliances: The Contractor shall furnish and install horns, strobes, and accessories to operate on compatible notification appliance circuits (NAC).
- B. Visible/Only: Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. V/O appliances shall be provided with different minimum flash intensities of 15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.
- C. Audible/Visible: Combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The horn shall comply with UL 464. The audible/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings.

## **2.05 ADDRESSABLE CIRCUIT INTERFACE MODULES**

- A. Addressable Circuit Interface Modules: Arrange to monitor one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of evacuation indicating appliances and AHU systems.
- B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line or a separate two wire pair running from an appropriate power supply as required.
- C. Addressable Modules:

1. Type 1: Addressable Input Monitor Module: This type of module is an individually addressable module that has both its power and its communications supplied by the two-wire multiplexing signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall communicate three zone status conditions (normal, alarm, trouble) to the FACP.
  2. Type 2: Addressable Output Monitor Module: This type of module is an individually addressable module that has both its power and its communications supplied by the two-wire multiplexing signaling line circuit. It provides programmable relay contacts to control power or signal to a controlled circuit. This module shall communicate three zone status conditions (normal, alarm operation, trouble) to the FACP.
  3. Type 3: Addressable Releasing Control Module: This type of module is an individually addressable module that requires both auxiliary power and communications supplied by separate circuits. It provides programmable relay contacts to control power to the releasing solenoid for the pre-action sprinkler system. This module shall communicate three zone status conditions (normal, alarm operation, trouble) to the FACP.
- D. The Addressable Module shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

## **2.06 REMOTE ANNUNCIATION**

- A. Provide a LCD annunciator with all devices in the system displayed.

## **2.07 EMERGENCY POWER SUPPLY**

- A. General: Components include battery, charger, and an automatic transfer switch.
- B. Battery: Sealed lead-acid or nickel cadmium type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 5 minutes.
- C. Fire alarm system primary power will be supplied by a emergency generator backed panel Circuit designation shall be provided by the building owner or representative.

## **2.08 AUXILIARY CONTROL DEVICES – ELECTRIC**

- A. Control Relays: Shall be UL listed plug-in type with dust cover and LED "energized" indicator. Contact rating, configuration and coil voltage shall be suitable for the application.

## **PART 3 - PART 3 – EXECUTION**

### **3.01 INSTALLATION, GENERAL**

- A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.

### **3.02 EQUIPMENT INSTALLATION**

- A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.
- B. Water-Flow, Air Pressure and Valve Supervisory Switches: Connection for each sprinkler valve, air pressure switch and water flow pressure switch is required to be supervised.
- C. All field devices shall be provided with a printed address label identifying the loop address. The label shall be affixed to the outside of the finish cover or to the device base.

### 3.03 WIRING INSTALLATION

- A. Wiring shall be plenum rated. Wiring shall be installed in conduit in the power rooms, data halls, future data halls, and all areas open to the structure. Plenum rated cable can be run open, above and supported in accordance with NEC requirements in office areas with drop-in ceilings. Plenum cable shall be supported a minimum of every five feet to the building structure. Where below seven feet and not protected by the building structure, wiring shall be in conduit.
- B. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).
- C. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.
- D. Color Coding: Color-code individual fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for signaling line circuits. Color-code notification appliance circuits differently from alarm-initiating and signaling line circuits. Paint fire alarm system Conduit, junction boxes and covers red. Covers shall carry a permanent identifier indicating "Fire Alarm", "FA", or similar indication.

### 3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
  - 1. Factory trained and National Institute for Certification in Engineering Technologies (NICET) or International Municipal Signal Association (IMSA) fire alarm certified.
  - 2. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
- C. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
  - 1. Factory trained and NICET (minimum Level II) or IMSA fire alarm (minimum Level II) certified.
  - 2. Personnel licensed or certified by state or local authority.
- D. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
- E. Final Test Notice: Provide a 5-day minimum notice in writing when the system is ready for final acceptance testing. A final acceptance test will not be scheduled until the operation and maintenance (O&M) manuals are furnished to the Engineer and the following are provided at the job site:
  - 1. Marked-up red line drawings of the system as actually installed.
  - 2. Complete Program printout including input/output addresses.
  - 3. NFPA 72 Record of Completion documents.
  - 4. NFPA 72 Test and Inspection documents.

- F. Minimum System Tests: 100% test of the system according to the procedures outlined in NFPA 72.
- G. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
- H. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.
- I. Final Testing:
  - 1. The final tests shall be witnessed by the Owner's representative and the local Authority Having Jurisdiction. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

### **3.05 CLEANING AND ADJUSTING**

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.
- B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

### **3.06 TRAINING**

- A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
  - 1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 4 hours' training.
  - 2. Schedule training with the Owner at least fourteen days in advance.

**END OF SECTION**

**SECTION 31 1000**  
**SITE CLEARING**

**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. Protecting existing vegetation to remain.
  - 2. Removing existing vegetation.
  - 3. Clearing and grubbing.
  - 4. Stripping and stockpiling topsoil.
  - 5. Removing above- and below-grade site improvements.
  - 6. Disconnecting, capping or sealing, and removing site utilities.
  - 7. Temporary erosion- and sedimentation-control measures.
- B. Related Sections:
  - 1. Section 015000 "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities.
  - 2. Section 017300 "Execution" for field engineering and surveying.
  - 3. Section 017419 "Construction Waste Management and Disposal.
  - 4. Geotechnical Study performed by Geomat Inc. and the report: "Geotechnical Engineering Report, Dyron Murphy Architects, Shiprock Pinnacle Hotel and Restaurant, Shiprock, New Mexico" issued for this project on May 5, 2023. Geomat Inc. can be reached at phone number (505) 327-7928.

**1.3 DEFINITIONS**

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
- D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

**1.4 MATERIAL OWNERSHIP**

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.
  2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

## **1.6 QUALITY ASSURANCE**

- A. Preinstallation Conference: Conduct conference as needed.

## **1.7 PROJECT CONDITIONS**

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
1. Do not proceed with work on adjoining property until directed by Architect.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
- F. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
  2. Parking vehicles or equipment.
  3. Foot traffic.
  4. Erection of sheds or structures.
  5. Impoundment of water.
  6. Excavation or other digging unless otherwise indicated.
  7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
- I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.

- B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches above the ground.
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

### **3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### **3.3 TREE AND PLANT PROTECTION**

- A. General: Protect trees and plants remaining on-site.
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

### **3.4 EXISTING UTILITIES**

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
  - 1. Arrange with utility companies to shut off indicated utilities.
- B. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

### **3.5 CLEARING AND GRUBBING**

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
  - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  - 2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
  - 3. Use only hand methods for grubbing within protection zones.
  - 4. Chip removed tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  - 1. Place fill material in horizontal layers not exceeding a loose depth of 6 inches, and compact each layer to a density equal to adjacent original ground.

### **3.6 TOPSOIL STRIPPING**

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth indicated on Drawings in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
1. Limit height of topsoil stockpiles to 72 inches.
  2. Do not stockpile topsoil within protection zones.
  3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

### **3.7 SITE IMPROVEMENTS**

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
  2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

### **3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

**END OF SECTION**



**SECTION 31 2000**  
**EARTH MOVING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Excavating and filling for grading the Site.
  - 2. Preparing subgrades for slabs-on-grade, walks, and pavements.
  - 3. Base course for concrete walks and concrete and asphalt paving.
  - 4. Excavating and backfilling trenches for utilities
- B. Related Documents
  - 1. Geotechnical Study performed by Geomat Inc. and the report: "Geotechnical Engineering Report, Dyron Murphy Architects, Shiprock Pinnacle Hotel and Restaurant, Shiprock, New Mexico" issued for this project on May 5, 2023. Geomat Inc. can be reached at phone number (505) 327-7928.

**1.2 DESCRIPTION OF WORK:**

- A. Fill construction shall consist of the placing and compacting of approved material within areas where unsuitable material has been removed; the placing and compacting of material in holes, pits and other depressions.
- B. Preparation of sub grade for walks and pavements is included as part of this work.
- C. Backfilling of trenches included as part of this work.
- D. Definition – "Excavation" consists of removal of material encountered to sub grade elevations indicated and subsequent disposal of materials removed.

**1.3 DEFINITIONS:**

- A. Backfill: Soil material used to fill an excavation.
  - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subgrade and hot-mix asphalt paving and concrete walks and paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
  - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.

- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below base course, drainage fill, drainage course, or topsoil materials.
- J. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

#### **1.4 PREINSTALLATION MEETINGS**

- A. Pre-installation Conference: Conduct pre-excavation conference at Project site.

#### **1.5 SUBMITTALS**

- A. Product Data: For each type of the following manufactured products required:
  - 1. Geotextiles.
  - 2. Warning tapes.
- B. Samples for Verification: For the following products, in sizes indicated below:
  - 1. Geotextile: 12 by 12 inches.
  - 2. Warning Tape: 12 inches long; of each color.
- C. Testing Reports: Submit following reports directly to the Architect/Engineers from a qualified testing agency, with copy to Contractor.
  - 1. Test reports for onsite and borrow material for fill and backfill.
  - 2. Inspection of sub grade to check actual soil conditions.
  - 3. Field density test reports.
  - 4. One optimum moisture-maximum density curve for each type of soil encountered.
  - 5. Report of testing performed to determine suitability of materials used.

#### **1.6 QUALITY ASSURANCE**

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Testing and Inspection Service: Employ, at Contractor's expense, testing laboratory to perform soil testing and inspection service for quality control testing during earthwork operations.

#### **1.7 PROJECT CONDITIONS**

- A. Site Information: Data on indicated subsurface conditions are not intended a representations or warranties of accuracy or continuity between soil bearings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn there from by Contractor. Data are made available for convenience of Contractor.
- B. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.
- C. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- D. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.
- E. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

- F. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperated with Architect/Engineer and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
- G. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by the Architect/Engineer and then only after acceptable temporary utility services have been provided.
- H. Provide a minimum of 48-hour notice to the Architect/Engineer, and received written notice to proceed before interrupting any utility.
- I. Use of Explosives: The use of explosives is not permitted.
- J. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
- K. Operate warning lights as recommended by authorities having jurisdiction.
- L. Protect structures, utilities, sidewalks, pavements and other facilities from damage cause by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
- M. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 01 Section "Temporary Facilities and Controls," are in place.

## **PART 2 - PRODUCTS**

### **2.1 SOIL MATERIALS**

- A. General: Provide material in accordance with the project geotechnical report. Use the requirements below for items not specifically addressed in the project geotechnical report. Imported materials may be required to meet the criteria given in the geotechnical report and noted below.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand.
  - 1. Coarse Aggregate Type: Conforming to New Mexico State Department of Transportation standard specification requirements of Section 303 for Type I Base Course.
- E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

### **2.2 GEOTEXTILES**

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from 100% polypropylene staple filaments; with elongation at break greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
  - 1. Survivability: Class 3; AASHTO M 288.
  - 2. Tensile Strength: 120 lbf; ASTM D 4632.

3. Trapezoidal Tear: 50 lbf; ASTM D 4533.
  4. CBR Puncture: 310 lbf; ASTM D 6241.
  5. Apparent Opening Size: No. 70 sieve, maximum; ASTM D 4751.
  6. Permittivity: 1.7 second<sup>-1</sup>, minimum; ASTM D 4491.
  7. Water Flow Rate: 135 g/min/sf; ASTM D 4491.
  8. UV Resistance: 70 percent after 500 hours' exposure; ASTM D 4355.
- B. In the placement of the geotextile for drainage applications, the geotextile shall be placed loosely with no wrinkles or folds, and with no void spaces between the geotextile and the ground surface. Successive sheets of geotextiles shall be overlapped a minimum of 12 in., with the upstream sheet overlapping the downstream sheet.
  - C. Should the geotextile be damaged during installation or riprap placement, a geotextile patch shall be placed over the damaged area extending beyond the damaged area a distance of 12 in., or the specified seam overlap, whichever is greater.

### **2.3 ACCESSORIES**

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of authorities having jurisdiction.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### **3.2 EXCAVATION, GENERAL**

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

### **3.3 EXCAVATION FOR STRUCTURES**

- A. Excavation is Unclassified, and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.
- B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Architect/Engineer. Unauthorized excavation, as well as remedial work directed by the Architect/Engineer, shall be at Contractor's expense.
- C. Under retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to the Architect/Engineer.

- D. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by the Architect/Engineer.
- E. Additional Excavation: When excavation has reached required sub grade elevations, notify Architect/Engineer who will make an inspection of conditions.
  - 1. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Architect/Engineer and/or as outlined in the geotechnical engineering reports.
- F. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
  - 1. Maintain sides and slopes of excavations in safe conditions until completion of backfilling.
- G. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F.

### **3.4 EXCAVATION FOR WALKS AND PAVEMENTS**

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### **3.5 EXCAVATION FOR UTILITY TRENCHES**

- A. Trenching for site utilities coordinate with Navajo Tribal Utility Authority's Technical Specifications for Materials and Workmanship for Water and Wastewater Facilities.
- B. Excavation for Trenches: Dig trench to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
  - 1. For pipes or conduit 5" or less in nominal size and for flat-bottomed multiple-duct conduit units, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
  - 2. For pipes or conduit 6" or larger in nominal size, tanks and other mechanical/electrical work indicated to receive sub-base, excavate to sub-base depth indicated, or, if not otherwise indicated, to 6" below bottom or work to be supported. Except as otherwise indicated, excavate for exterior water-bearing piping (water, steam, condensate, drainage) so top of piping is not less than 3'-6" below finished grade.
  - 3. Grade bottoms of trenches as indicated, notching under pipe bells to provide soil bearing for entire body of pipe.
  - 4. Do not backfill trenches until tests and inspections have been made and backfilling authorized by the Architect/Engineer. Use care in backfilling to avoid damage or displacement or pipe systems.
- C. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
  - 1. Do not allow water to accumulate in excavations. Remove water to prevent soil changes detrimental to stability of subgrades. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

### **3.6 SUBGRADE INSPECTION**

- A. Proof-roll subgrade below the pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### **3.7 UNAUTHORIZED EXCAVATION**

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 3000 psi, may be used when approved by Architect.
  - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

### **3.8 STORAGE OF SOIL MATERIALS**

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Located and retain soil materials away from edge of excavations. Do not store within drop line of trees indicated to remain.
  - 2. Dispose of excess soil material and waste materials as herein specified.

### **3.9 UTILITY TRENCH BACKFILL**

- A. Utility trenching and backfilling shall be in accordance with N.T.U.A. Technical Specifications for Materials and Workmanship for Water and Wastewater Facilities, Technical Provision (TP) 1.0.

### **3.10 SOIL FILL**

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use engineered fill.

### **3.11 SOIL MOISTURE CONTROL**

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### **3.12 COMPACTION, GENERAL**

- A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification as outlined in the geotechnical engineering reports.
  - 1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
  - 2. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

### **3.13 COMPACTION OF SOIL BACKFILLS AND FILLS**

- A. General: Place acceptable soil material in layers to required subgrade elevations, for each areas classification listed below, as outlined in the geotechnical engineering reports.
- B. In excavation, use satisfactory excavated or borrow material.
- C. Under grassed areas, use satisfactory excavated or borrow material.

- D. Under walks and pavements, use sub-base material, or satisfactory excavated or borrow material, or combination of both.
- E. Under steps, use sub-base material.
- F. Under piping and conduit, use sub-base material where sub-base is indicated under piping or conduit; shape to fit bottom 90° of cylinder.
- G. Backfill excavations as promptly as work permits, but not until completion of the following:
  1. Acceptance of construction below finish grade including, where applicable, damp-proofing, waterproofing and perimeter insulation.
  2. Inspection, testing, approval and recording locations of underground utilities.
  3. Removal of concrete formwork.
  4. Removal of trash and debris.
  5. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
- H. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil material, obstructions and deleterious materials from ground surface prior to placement of fills. Plow, strip or bread-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
  1. When existing ground surface has a density less than that specifies under “Compaction” for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content and compact to required depth and percentage of maximum density.
- I. Placement and Compaction: Place backfill and fill materials in layers not more than 8” in loose depth for material compacted by heavy compaction equipment, and not more than 4” in loose depth for material compacted by hand-operated tampers. Coordinate with requirements as outlined in the geotechnical engineering report.
  1. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each areas classification. Do not place backfill or fill material on surfaces that are muddy, frozen or contain frost or ice.
  2. Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

### **3.14 GRADING**

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding.
- C. Finish surfaces free from irregular surface changes, and as follows:
- D. Lawn or Unpaved Areas: Finish area to receive topsoil to within now more than 0.10’ above or below required subgrade elevations.
- E. Walks and Pavements: Shape surface or areas under pavement to line, grade and cross-section, with finish surface not more than 0.10’ above or below required subgrade elevation.
- F. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each areas classification as outlined in the geotechnical engineering reports.

### **3.15 BASE COURSES UNDER PAVEMENTS AND WALKS**

- A. Place base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place base course under pavements and walks as follows:
  - 1. Shape base course to required crown elevations and cross-slope grades.
  - 2. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  - 3. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

### **3.16 FIELD QUALITY CONTROL**

- A. Special Inspections: Contractor will engage a qualified special inspector to perform the following special inspections:
  - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
  - 2. Determine that fill material and maximum lift thickness comply with requirements.
  - 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Contractor will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.
- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
- F. If, in the opinion of the Architect/Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

### **3.17 PROTECTION**

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### **3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

### **END OF SECTION**



## SECTION 31 3700

### RIP RAP

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Placement of loose riprap.
  - 2. Placement of hand-placed riprap.

##### 1.2 DESCRIPTION OF WORK:

- A. Rip Rap construction shall consist of the hand placing of approved materials for erosion protection.

##### 1.3 SUBMITTALS

- A. Submit prior to use in the Work product data showing riprap source, gradation, aggregate wear and placement technique.

##### 1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout Work.
- B. Perform Work according to industry standards.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

- A. Riprap:
  - 1. Durable, angular, hard stone free from seams, cracks, and coatings and of such characteristics that it will not disintegrate when subject to the action of flowing water.
  - 2. The minimum specific gravity of the stone shall be 2.65.
  - 3. The maximum resistance to abrasion shall be fifty (50) percent determined in accordance with the requirements of ASTM C535.
  - 4. The maximum soundness loss shall be twenty (20) percent determine in accordance with ASTM C88.
  - 5. The maximum loss to freeze thaw shall be ten (10) percent for 12 cycles determined in accordance with the AASHTO T103, Ledge R, Procedure A.
  - 6. Riprap material shall be rectangular in shape rectangular in shape having maximum to minimum dimension ratio not more than 3:1.
- B. Accessories
  - 1. Geotextile fabric, Section 312000 Earth Moving.
- C. Source Quality Control
  - 1. Riprap: Wear not greater than 40 percent when tested, ASTM C 535.

#### PART 3 - EXECUTION

##### 3.1 PREPARATION

- A. Remove all brush, trees, stumps, and other objectionable materials and dress area to a smooth surface. Make Excavation to provide a firm foundation and protect against undercutting. Secure approval prior to backfilling.
- B. Install required geotextile in accordance with Section 312000 Earth Moving.

##### 3.2 PLACEMENT

- A. The placement of riprap stone shall be to the line and grade shown on the plans or as authorized by the ENGINEER.
- B. When the required riprap is less than 20 inches in depth, stone shall be placed by hand unless otherwise authorized by the ENGINEER. Stones shall be placed to provide minimum of voids. The larger stone shall be placed in the toe return, foundation course, and on the outer surface of the riprap. Stones shall be placed with their longitudinal axis normal to the face of the embankment and so arranged that each rock above the foundation course has at least 3 point bearing on the underlying stones. Bearing on smaller stones used to chink voids will not be acceptable. Interstices between stones shall be chinked with small stones and spalls. The finished surface shall be even and tight and shall not vary from the planned surface by more than 3 inches per foot in depth. When the required

riprap is 20 inches or more in depth, the stone may be placed by dumping and spread in layers by bulldozers or other suitable equipment.

**3.3 LOOSE-PLACED RIPRAP**

- A. Place stones to secure a Rock mass with the minimum thickness and height indicated. Manipulate Rock to secure a regular surface of graded size and mass stability.

**3.4 HAND-PLACED RIPRAP**

- A. Place and bed the Rocks, one against the other, and key together. Fill irregularities between stones with suitable size spalls.
- B. Place so that finished surface of riprap is even, tight, and true to line and grade. Extend riprap sufficiently below ground surface to secure a firm foundation.

**END OF SECTION**

**SECTION 32 1216  
ASPHALT PAVING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Hot-mix asphalt patching.
  - 2. Hot-mix asphalt paving.
  - 3. Pavement-marking paint applied to asphalt pavement.
  - 4. Asphalt traffic-calming devices.
- B. Related Sections:
  - 1. Section 312000 Section "Earth Moving" for subgrade and aggregate base courses.
  - 2. Geotechnical Study performed by Geomat Inc. and the report: "Geotechnical Engineering Report, Dyron Murphy Architects, Shiprock Pinnacle Hotel and Restaurant, Shiprock, New Mexico" issued for this project on May 5, 2023. Geomat Inc. can be reached at phone number (505) 327-7928.

**1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
  - 1. Job-Mix Designs – NMDOT Standard Specifications for Highway and Bridge Construction 2019. Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
  - 2. Job-Mix Designs: For each job mix proposed for the Work.
  - 3. Pavement Markings.
- B. Material Certificates: For each paving material, from manufacturer.
- C. Material Test Reports: For each paving material, by a qualified testing agency.
- D. Field quality-control reports.

**1.3 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the Department of Transportation of the state in which the Project is located.
- B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the Section 416 of NMDOT Standard Specifications for Highway and Bridge Construction 2019 for asphalt paving work.
  - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
- C. Testing Agency Qualifications: Qualified according to ASTM D3666 for test indicated.

**1.4 FIELD CONDITIONS**

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
  - 1. Prime Coat: Minimum surface temperature of 60 degrees F.
  - 2. Tack Coat: Minimum surface temperature of 60 degrees F.
  - 3. Asphalt Base Course: Minimum surface temperature of 40 degrees F and rising at the time of placement.
  - 4. Asphalt Surface Course: Minimum surface temperature of 60 degrees F at time of placement.
  - 5. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

## **PART 2 - PRODUCTS**

### **2.1 AGGREGATES**

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073 sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
  - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D 242 rock or slag dust, hydraulic cement, or other inert material.

### **2.2 ASPHALT MATERIALS**

- A. Asphalt Binder: AASHTO M 320, PG 64-22.
- B. Tack Coat: AASHTO M 140 emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- C. Emulsified Asphalt Prime Coat: AASHTO M 140 emulsified asphalt, or AASHTO M 280 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

### **2.3 AUXILIARY MATERIALS**

- A. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

### **2.4 MIXES**

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Hot-Mix Asphalt – NMDOT Mix SP-III or SP-IV per NMDOT Standard Specifications for Highway and Bridge Construction 2019. Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
  - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
  - 2. Base Course: Per NMDOT Standard Specifications for Highway and Bridge Construction.
  - 3. Surface Course: Per NMDOT Standard Specifications for Highway and Bridge Construction.

### **2.5 PAVEMENT MARKINGS**

- A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N, F, or S, colors complying with FS TT-P-1952.
  - 1. Color: As indicated.
- B. Glass Beads: AASHTO M 247, Type 1
  - 1. Roundness: Minimum 75 percent true spheres by weight

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify gradients and elevations of base.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

### **3.2 EXAMINATION FOR PAVEMENT MARKING**

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

### **3.3 PATCHING**

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 24 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.10 gal/sq. yd.
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

### **3.4 SURFACE PREPARATION**

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- C. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
  - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  - 2. Protect primed substrate from damage until ready to receive paving.

### **3.5 HOT-MIX ASPHALT PLACING**

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  - 1. Spread mix at minimum temperature of 250 deg F
  - 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### **3.6 JOINTS**

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
  - 1. Clean contact surfaces and apply tack coat to joints.
  - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
  - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.

4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

### **3.7 COMPACTION**

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
  1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### **3.8 ASPHALT TRAFFIC-CALMING DEVICES**

- A. Construct hot-mix asphalt speed humps over compacted pavement surfaces. Apply tack coat unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of 250 deg F.
  1. Tack Coat Application: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
  2. Asphalt Mix: Same as pavement surface-course mix.
  3. Before installation, mill pavement that will be in contact with bottom of traffic-calming device. Mill to a depth of 1 inch from top of pavement to a clean, rough profile.
- B. Place and compact hot-mix asphalt to cross section indicated, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

### **3.9 INSTALLATION TOLERANCES**

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  1. Base Course: Plus or minus 1/2 inch.
  2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 12-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
  2. Surface Course: 1/8 inch.
  3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
- C. Asphalt Traffic-Calming Devices: Compact and form asphalt to produce the contour indicated and within a tolerance of plus 1/4 inch of height indicated above pavement surface.

### **3.10 PAVEMENT MARKING**

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

### **3.11 FIELD QUALITY CONTROL**

- A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
  1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
  2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
    - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- F. Replace and compact hot-mix asphalt where core tests were taken.
- G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

### **3.12 DISPOSAL**

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

**END OF SECTION**

**SECTION 32 1313  
CONCRETE PAVING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes concrete paving for:
  - 1. Concrete driveways and roadways.
  - 2. Concrete curbs and gutters.
  - 3. Concrete sidewalks.
- B. Related Sections:
  - 1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
  - 2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
  - 3. Geotechnical Study performed by Geomat Inc. and the report: "Geotechnical Engineering Report, Dyron Murphy Architects, Shiprock Pinnacle Hotel and Restaurant, Shiprock, New Mexico" issued for this project on May 5, 2023. Geomat Inc. can be reached at phone number (505) 327-7928.

**1.2 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, and ground granulated blast-furnace slag.

**1.3 SUBMITTALS**

- A. Product Data: For each Type of product indicated.
- B. Design Mixtures:
  - 1. For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Qualification Data: For qualified Installer of ready-mix concrete manufacturer and testing agency.
- D. Material Certificates: For the following, from manufacturer:
  - 1. Cementitious materials.
  - 2. Steel reinforcement and reinforcement accessories.
  - 3. Fiber reinforcement.
  - 4. Admixtures.
  - 5. Curing compounds.
  - 6. Applied finish materials.
  - 7. Bonding agent or epoxy adhesive.
  - 8. Joint fillers.
- E. Material Test Reports: For each of the following:
  - 1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- F. Field quality-control reports.

**1.4 QUALITY ASSURANCE**

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").



- B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- C. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- D. ACI Publications: Comply with ACI 301 unless otherwise indicated.
- E. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to concrete paving, including but not limited to, the following:
    - a. Concrete mixture design.
    - b. Quality control of concrete materials and concrete paving construction practices.
  - 2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete paving subcontractor.

## **1.5 PROJECT CONDITIONS**

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

## **PART 2 - PRODUCTS**

### **2.1 FORMS**

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
  - 1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

### **2.2 STEEL REINFORCEMENT:**

- A. Reinforcing Steel: ASTM A615, 40 ksi yield grade, deformed billet bars.
- B. Welded Plain Wire Fabric: ASTM A185; in flat sheets; galvanized finish.
- C. Dowels: ASTM A615; 40 ksi yield strength, plain steel bars; cut to length indicated on Drawings, square ends with burrs removed.
- D. Plain Steel Wire: ASTM A82, minimum 16 gage.

### **2.3 CONCRETE MATERIALS:**

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
  - 1. ASTM C150, Type II Portland type with addition of with the following:
    - a. Fly Ash: ASTM C 618, Class F.
- B. Fine and Coarse Aggregates: ASTM C33, Class 4, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: Potable and complying with ASTM C94.
- D. Air Entrainment: ASTM C260.
- E. Chemical Admixture: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
  1. Water Reducing Admixture: ASTM C494, Type A.
  2. Retarding Admixture: ASTM C 494, Type B.
  3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
  4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
  5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
  6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

## **2.4 CURING MATERIALS**

- A. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- B. Liquid Membrane-Forming Curing Compound: ASTM C309, Type 1, Class A or B.
- C. Absorptive Cover: AASHTO M182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

## **2.5 RELATED MATERIALS**

- A. Joint Filler: Preformed durable resilient bituminous material and comply with ASTM D1751 or AASHTO M213.

## **2.6 CONCRETE MIXTURES**

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
  1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
  2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
  1. Compressive Strength at 28 days: 4,000 psi minimum.
  2. Maximum Water-Cementitious Material Ratio at Point of Placement: 0.45
  3. Slump: 4 inches, plus or minus 1 inch.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
  1. Air Content: 5-1/2 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.
  2. Air Content: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
  3. Air Content: 6 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.
- D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
  1. Use water-reducing admixture in concrete as required for placement and workability.
  2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  1. Fly Ash or Pozzolan: 25 percent.

## **2.7 CONCRETE MIXING**

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Furnish batch certificates for each batch discharged and used in the Work.
  - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch plant located on or near the project site.
  - 1. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
  - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
  - 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
  - 3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 Earth Moving.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

### **3.3 INSTALLATION**

- A. Edge Forms and Screed Construction
  - 1. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
  - 2. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.
- B. Steel Reinforcement
  - 1. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
  - 2. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
  - 3. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- C. Joints:
  - 1. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
    - a. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

2. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
  - a. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
3. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
4. Expansion Joints: Expansion joints shall be constructed to the full depth and width of the concrete. The expansion joint material shall extend fully through the concrete and one inch into the subgrade with the top of the expansion joint material one-quarter inch below the top surface. Expansion joint material shall be secured in place prior to placement of concrete. Expansion joints shall be installed along all abutting structures to provide complete separation from the structure. Sidewalk, curb, and gutter expansion joints shall be installed at all radius points, at both sides of each driveway.
5. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Unless otherwise specified, the large aggregate in contraction joints shall be separated to either side of the joint for a minimum depth equal to 25% of the concrete thickness; the finished depth shall be a minimum of 3/4 inch.
6. Edging: After initial floating, all exposed edges shall be shaped with a suitable tool to form edges having the shape as indicated on the referenced detail. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

D. Placing Concrete:

1. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
2. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
3. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
4. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
5. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
6. Deposit and spread concrete in a continuous operation between transverse joints.
7. Do not push or drag concrete into place or use vibrators to move concrete into place. Do not disturb reinforcing or formwork components during concrete placement.
8. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
9. Screed paving surface with a straightedge and strike off.
10. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
11. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
  - a. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
  - b. Do not use frozen materials or materials containing ice or snow.
  - c. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

12. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
    - a. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
    - b. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
    - c. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.
- E. Finishing:
1. General: Do not add water to concrete surfaces during finishing operations.
  2. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
    - a. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
    - b. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
    - c. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
  3. Driveway and Roadway Surfaces: Light broom.
  4. Sidewalk Surfaces: Light broom, trowel joint edges.
  5. Curbs and Gutters: Light broom.
    - a. Flow Lines: Smooth finish.
  6. Apply curing compound on exposed concrete surfaces immediately after finishing.
- F. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
  3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

### **3.4 TOLERANCES**

- A. Driveway and Roadway:

1. All finished concrete elevations shall not deviate from the elevations shown on the plans, or indicated by typical sections or standard details referenced within the construction documents, by more than 1/2 inch.
- B. Curb and Gutter:
1. The face, top, back, and flow line of the curb and gutter shall not deviate in excess of 1/4-inch over 10 feet, as tested with a 10-foot straightedge or curve template, longitudinally along the surface.
- C. Sidewalk:
1. Surface of concrete sidewalk shall not deviate in excess of 1/8-inch over 5 feet as tested with a 5-foot straightedge except for the 1/4-inch recess of the preformed material in expansion joints.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections. Inspect reinforcing placement for size, spacing, location, support.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
  5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
  6. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days.
    - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

- G. Concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

### **3.6 REPAIRS AND PROTECTION**

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

**END OF SECTION**

**SECTION 32 1373**  
**CONCRETE PAVING JOINT SEALANTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes cold and hot-applied pavement joint sealants in the following locations:
  - 1. Portland Cement concrete pavement expansion and contraction joints.
  - 2. Joints between Portland Cement concrete and asphalt pavement

**1.2 SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For each kind and color of joint sealant required.
- C. Product test reports.
- D. Sealant compatibility and adhesion test reports.

**1.3 QUALITY ASSURANCE**

- A. Sealant Compatibility and Adhesion Testing: Use sealant manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
  - 2. Products: Subject to compliance with requirements, provide one of the products specified.

**2.2 GENERAL, MATERIALS**

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
  - 1. Primers: Product recommended in writing by joint sealant manufacturer for adhesion of sealant to joint substrates indicated, as determined from sealant compatibility and adhesion tests and prior experience.
- B. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.
  - 1. Round Backer Rod for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.
  - 2. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depths, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
  - 3. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

**2.3 COLD-APPLIED JOINT SEALANTS**

- A. Multicomponent Jet-Fuel-Resistant Sealant for Concrete: ASTM C 920, pourable, chemically curing elastomeric formulation.



1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, O.
    - a. Products:
      - 1) Pecora Corporation; Urexpam NR-300.
      - 2) Engineer Approved.
  2. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and, as applicable to joint substrates indicated, O.
    - a. Products:
      - 1) Meadows, W. R., Inc.; SEALTIGHT GARDOX.
      - 2) Engineer Approved.
  3. Bitumen-Modified Urethane Formulation: Type M; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.
    - a. Products:
      - 1) Mameco International; Vulkem 202.
      - 2) Sonneborn Building Products Div., ChemRex, Inc.; Sonomeric 2.
      - 3) Engineer Approved.
- B. Nonsag Silicone Sealant for Concrete: ASTM D 5893, Type NS, single-component, low-modulus, neutral-curing, nonsag silicone sealant.
1. Products:
    - a. Crafcoc Inc.; Roadsaver Silicone-SL.
    - b. Dow Corning; 888.
    - c. Engineer Approved.
- C. Self-Leveling Silicone Sealant for Concrete and Asphalt: ASTM D 5893, Type SL, single-component, low-modulus, neutral-curing, self-leveling silicone sealant.
1. Products:
    - a. Dow Corning; 890-SL.
    - b. Engineer Approved.
- D. Multicomponent Low-Modulus Sealant for Concrete and Asphalt: Proprietary, pourable, self-leveling formulation of reactive petropolymer and activator.
1. Products:
    - a. Meadows, W. R., Inc.; SOF-SEAL.
    - b. Engineer Approved.
- 2.4 HOT-APPLIED JOINT SEALANTS**
- A. Elastomeric Sealant for Concrete: ASTM D 3406.
1. Products:
    - a. Crafcoc, Inc.; Superseal 444/777.
    - b. Meadows, W. R., Inc.; POLY-JET 3406.
    - c. Engineer Approved.
- B. Sealant for Concrete and Asphalt: ASTM D 3405.
1. Products:
    - a. Crafcoc Inc.; ROADSAVER 221.
    - b. Koch Materials Company; Product #9005.
    - c. Meadows, W. R., Inc.; SEALTIGHT HI-SPEC.
    - d. Engineer Approved.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Clean out joints immediately before installing joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or recommended in writing by joint sealant manufacturer, based on sealant compatibility and adhesion tests and prior experience. Confine primers to areas of joint-sealant bond; do not spill primers or allow them to migrate onto adjoining surfaces.
- C. Sealant Installation: Comply with applicable recommendations in ASTM C 1193.
- D. Install backer materials to support sealants during application and at position required to produce optimum sealant movement capability.
  - 1. Do not leave gaps between ends of backer materials.
  - 2. Do not stretch, twist, puncture, or tear backer materials.
  - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials
- E. Install sealants at same time backer materials are installed.
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses provided for each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths optimize sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealants from surfaces adjacent to joint.
  - 2. Use tooling agents that are approved in writing by joint sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- G. Clean excess sealants or sealant smears adjacent to joints as installation progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

**END OF SECTION**

**SECTION 32 1413.13  
INTERLOCKING CONCRETE UNIT PAVING ON AGGREGATE BASE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes
1. Work consists of furnishing and installing an Interlocking Concrete Pavement System in accordance with these specifications and in general conformance with the lines, grades, design, and dimensions shown on the plans.
  2. Installation work includes:
    - a. Verifying subgrade elevations and slopes generally conform to the lines, grades and site conditions depicted in the construction documents;
    - b. Furnishing and installing geotextile (where required), base course, bedding course, edge restraint, concrete pavers and joint filling sand as shown on the construction drawings.
- B. Related Requirements:
1. Section 31 2000 Earth Moving
  2. Section 31 0519.13 Geotextiles for Earthwork
  3. Section 32 1216 Asphalt Paving
  4. Section 32 1313 Concrete Paving
  5. Section 32 1700 Paving Specialties (parking bumpers, tactile warnings)

**1.2 REFERENCES**

- A. American Association of State Highway and Transportation Officials (AASHTO)
1. GDPS-4-M Guide for Design of Pavement Structures
- B. American Society of Civil Engineers (ASCE)
1. ASCE 58-16 Structural Design of Interlocking Concrete Pavement for Municipal Streets and Roadways
- C. American Society for Testing and Materials (ASTM)
1. ASTM C33 Standard Specification for Concrete Aggregates
  2. ASTM C94 Standard Specification for Ready-Mixed Concrete
  3. ASTM C131 Resistance to Degradation of Small-Sized Course Aggregate by Abrasion and Impact in the Los Angeles Machine
  4. ASTM C136 Sieve Analysis of Fine and Coarse-Grained Aggregates
  5. ASTM C140 Sampling and Testing Concrete Masonry Units and Related Units
  6. ASTM C144 Aggregate for Masonry Mortar
  7. ASTM C936 Solid Concrete Interlocking Paving Units
  8. ASTM C979 Pigments for Integrally Colored Concrete
  9. ASTM C1645 Freeze-thaw and De-icing Salt Durability of Solid Interlocking Paving Units
  10. ASTM D698 Laboratory Compaction Characteristics of Soil Using Standard Effort
  11. ASTM D2488 Description and Identification of Soils (Visual-Manual Procedure)
  12. ASTM D2940 Graded Aggregate Material for Bases or Subbases for Highways or Airports
  13. ASTM D4873 Identification, Storage, and Handling of Geosynthetic Rolls and Samples

- D. American Association of State Highway and Transportation Officials (AASHTO):
  - 1. AASHTO M288 Geotextile Specification for Highway Applications
- E. Interlocking Concrete Pavement Institute (ICPI)
  - 1. Tech Specs and Technical Bulletins.

### **1.3 SUBMITTALS**

- A. Contractor shall submit to the owner for approval a minimum of four full-size samples of each concrete paver type/size/thickness/color/finish specified. The samples shall represent the range of shape, texture, and color permitted for the respective type. Color(s) will be selected by Architect from Manufacturer's standard colors.
- B. Prior to delivery of the associated material to the site, the Contractor shall submit the following product-specific documentation for approval:
  - 1. Aggregates
    - a. Sieve analysis per ASTM C136 for subbase, base, bedding and joint aggregate materials
    - b. Minimum 3 lb. sample of each material for independent testing.
  - 2. Concrete Pavers:
    - a. Test results from an independent testing laboratory for compliance with ASTM C936.
    - b. Manufacturer's catalog product data.
    - c. Safety Data Sheets (SDS).
  - 3. Geotextile
    - a. One 18-inch x 18-inch panel of each type of geotextile to be used for inspection and testing. The sample panels shall be uniformly rolled and shall be wrapped in plastic to protect the material from moisture and damage during shipment. Samples shall be externally tagged for easy identification. External identification shall include the name of the manufacturer; product type; product grade; lot number; and physical dimensions.
    - b. Current National Transportation Product Evaluation Program (NTPEP) evaluation report.
    - c. Safety Data Sheets (SDS).

### **1.4 QUALITY ASSURANCE**

- A. Contractor Qualifications:
  - 1. Contractor shall submit a list of five (5) previously constructed projects of similar size and magnitude prior to the bid date to be qualified. Contact names, telephone numbers, and date of completion shall be listed for each project.
  - 2. The Contractor's site foreman shall hold a Certified Concrete Paver Installer Designation from the Interlocking Concrete Pavement Institute (ICPI). The site foreman shall be onsite for the entire installation.
  - 3. Contractor shall conform to all local, state/provincial licensing and bonding requirements.
- B. Mockups: Build mockups to verify selections made under submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Install a 10 ft x 10 ft paver area following the installation practices described in Article 3.2 to 3.4. This area shall be used to verify joint sizes; lines; laying pattern(s); stitching details (for mechanical installation); color(s); and, texture of the job.

2. To provide a proper representation of color blend, blending during installation of sample mock-up will be pulled from a minimum of 3 cubes.
3. This area shall be the standard by which the work will be judged.
4. Subject to approval by the Owner, the mock-up may be retained as part of the finished work. If mock-up is not retained, remove and dispose of mock-up at the completion of the project.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Contractor shall coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.
- B. Contractor shall check all materials upon delivery to assure that the proper materials have been received and are in good condition before signing off on the manufacturer's packing slip.
- C. Contractor shall protect all materials from damage or contamination due to job site conditions and in accordance with manufacturer's recommendations. Damaged or contaminated materials shall not be incorporated into the work.
- D. Concrete pavers shall be delivered to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by forklift or clamp lift. Unload and store concrete pavers at the job site in such a manner that no damage occurs to the product.
- E. Contractor shall handle and transport aggregates to avoid segregation, contamination, and degradation and keep different materials sufficiently separated as to prevent mixing. The material shall not be dumped or stored one material on top of another unless it is part of the installation process. Materials shall be covered to prevent removal by wind.
- F. Geotextile shall be delivered, stored and handled in accordance with ASTM D4873.

## **1.6 ENVIRONMENTAL CONDITIONS**

- A. Pavers shall not be installed during heavy rain, freezing conditions or snowfall.
- B. Base course shall not be installed on frozen soil subgrade.
- C. Pavers, bedding course sand, and joint filling sand shall not be installed on frozen aggregates.

## **1.7 MAINTENANCE MATERIALS**

- A. Provide 20 square feet additional paver material for use by Owner for maintenance and repair.
- B. Store extra paver materials in Owner-designated location.

## **PART 2 - PRODUCTS**

### **2.1 INTERLOCKING CONCRETE PAVERS**

- A. Interlocking Concrete Pavers:

1. BASIS OF DESIGN: Tremron; Plank Pavers
    - a. Thickness: 4 inches
    - b. Color: Selected by architect
  2. Belgard Commercial; Melville Plank
    - a. Thickness: 4 inches
    - b. Color: Selected by architect
  3. Substitutions: See Section 01 6000 – Product Requirements
- B. Pavers shall meet the minimum material and physical properties set forth in ASTM C 936:
1. Measured length or width of test specimens shall not differ by more than +/- 0.063 in, while measured thickness shall not differ by more than +/- 0.125 in.
  2. Average compressive strength of not less than 8,000 psi (55 MPa) with no individual unit under 7,200 psi (50 MPa) when tested in accordance with ASTM C140.
  3. Average absorption of 5% or less with no unit greater than 7% when tested in accordance with ASTM C140.
  4. Efflorescence shall not be a cause for rejection.
  5. Pigment in Concrete Pavers shall conform to ASTM C979.

## 2.2 BEDDING SAND

- A. Bedding sand shall be clean, non-plastic sand, free from deleterious or foreign matter, and manufactured from crushed rock.
- B. Screenings or stone dust shall not be utilized.
- C. Verify gradation conforms to ASTM C33 requirements for concrete sand (listed in Table 1) as tested in accordance with ASTM C136.

Table 1  
Gradation Requirements for Bedding Sand

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8 inch (9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	85 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (0.600 mm)	25 to 60
No. 50 (0.300 mm)	5 to 30
No. 100 (0.150 mm)	0 to 10
No. 200 (0.075 mm)	0 to 1

## 2.3 JOINT FILLING SAND

- A. Joint sand aggregate shall be clean, non-plastic sand, free from deleterious or foreign matter, and manufactured from crushed rock.
- B. Screenings or stone dust shall not be utilized.
- C. Verify gradation conforms to ASTM C144 requirements for concrete sand (listed in Table 2) as tested in accordance with ASTM C136.

Table 2

### Gradation Requirements for Joint Filling Sand

<u>Sieve Size</u>	<u>Percent Passing</u>
No. 4 (4.75 mm)	100
No. 8 (2.36 mm)	95 to 100
No. 16 (1.18 mm)	70 to 100
No. 30 (0.600 mm)	40 to 100
No. 50 (0.300 mm)	10 to 35
No. 100 (0.150 mm)	2 to 15
No. 200 (0.075 mm)	0 to 5

## 2.4 BASE AGGREGATE

- A. Base aggregate shall be clean, non-plastic, free from deleterious or foreign matter, recycled concrete, and manufactured from crushed rock.
- B. Verify gradation conforms to ASTM D2940 as presented in Table 3.

Table 3  
Gradation Requirements for Base Course Material

<u>Sieve Size</u>	<u>Percent Passing</u>
2 in (50 mm)	100
1 ½ in (37.5 mm)	95 to 100
¾ in (19 mm)	70 to 92
3/8 in (9.5 mm)	50 to 70
No. 4 (4.75 mm)	35 to 55
No. 30 (0.600 mm)	12 to 25
No. 200 (0.075 mm)	0 to 8

## 2.5 EDGE RESTRAINTS

- A. Edge restraints shall be cast in place concrete curbs constructed at a minimum to the dimensions of the municipal standards.

## 2.6 GEOTEXTILES

- A. Geotextile materials shall be selected by the Design Engineer based on the intended use in accordance with AASHTO M288.
- B. Only geotextiles with a current NTPEP evaluation will be accepted.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prior to commencement of any work, the Contractor shall conduct a pre-construction meeting with the Owner, Designer, and affected sub-trades. The pre-construction meeting should establish contractor responsibilities and at a minimum verify:

1. The location of the mock-up, and whether it will be part of the final construction or need to be removed.
  2. The site layout is in general conformance with the construction documents.
  3. The subgrade lines and elevations are in general conformance with the construction documents. The subgrade elevations shall be within +/- 0.1 ft of the specified grades.
  4. Subgrade soil conditions and grades meet the requirements in the construction documents.
  5. The details of the site's erosion and sediment control plan.
- B. Proof-roll prepared subgrade according to requirements in Section 31 20 00 Earth Moving to identify soft pockets and areas of excess yielding. Proceed with subbase installation only after deficient subgrades have been corrected.
- C. Contractor shall verify compaction of the subgrade is in general conformance with the construction documents prior to placing subbase materials.
- D. Once the Contractor has confirmed the subgrade conditions are in general conformance with the requirements in the construction documents, the Contractor shall begin installing the base course material. By initiating installation of the base course, the Contractor acknowledges acceptance of the subgrade.

### **3.2 INSTALLATION OF BASE COURSE**

- A. Install Geotextiles as required in accordance with the construction documents. The Geotextile is applied to the bottom and sides of the excavation with overlapping joints a minimum of 12 inches. Overlaps to follow downslope.
- B. Install the base course at the thickness, compaction, surface tolerances, and elevations outlined in the construction documents.
1. The aggregate should be spread and compacted in uniform layers not exceeding 6-inch loose thickness.
  2. Compact base course to 98% Modified Proctor density per ASTM D1557.
  3. Density testing shall be conducted to verify conformance.
  4. Surface tolerance should be plus or minus 3/8 inch (10 mm) over a 10-foot. (3 m) straight edge laid in any direction.
  5. Base course compaction must be achieved near curbs, grade beams, concrete collars around utility structures, lights standards, tree wells, building edges and other protrusions as applicable to the project. In areas not accessible to large compaction equipment, compact to specified density with mechanical tampers (jumping jacks).
  6. The upper surface of the base shall be sufficiently well graded and compacted to prevent infiltration of the bedding sand into the base both during construction and throughout its service life. Segregated areas of the granular base shall be blended by the application of crushed fines that have been watered and compacted into the surface.
- C. Before commencing the placing of the bedding course, the base shall be inspected by the Owner or the Consultant.

### **3.3 INSTALLATION OF EDGE RESTRAINTS**

- A. Adequate edge restraint shall be provided along the perimeter of all paving as specified. The face of the edge restraint, where it abuts pavers, shall be vertical.



- B. All concrete edge restraints shall be constructed to dimensions and grades in general conformance with the construction documents and shall be supported on a compacted base not less than 6 inches thick. Concrete curbs shall meet local requirements or the requirements of Section 32 16 13 - Curbs and Gutters whichever is more restrictive. All concrete shall be in accordance with ASTM C94 requirements.

### **3.4 INSTALLATION OF BEDDING COURSE, PAVERS, AND JOINT FILLING MATERIAL**

- A. Spread the bedding course evenly over the base course and screed to a nominal 1-inch (25 mm) thickness. The Contractor shall screed the bedding course using either an approved mechanical spreader (e.g.: an asphalt paver) or by the use of screed rails and boards. The screeded sand should not be disturbed. Place sufficient sand to stay ahead of the laid pavers. Do not use the bedding sand to fill depressions in the base course surface.
- B. Ensure that concrete pavers are free of foreign material before installation. Concrete pavers shall be inspected for color distribution and all chipped, damaged or discolored concrete pavers shall be replaced. Initiation of concrete paver placement shall be deemed to represent acceptance of the pavers.
- C. Lay the concrete pavers in the pattern(s) as shown on the drawings. Maintain straight pattern lines.
- D. Paving units shall be installed from a minimum of 3 bundles by hand, and 6 bundles during mechanical installation, simultaneously to ensure color blending.
- E. Joints between the individual concrete pavers, and between concrete pavers and the edge restraints, buildings, collars, or other protrusions/edging, on average shall be between 1 /16 inch and 3 /16 inch (2 mm to 5 mm) wide.
- F. Joint (bond) lines shall not deviate more than  $\pm 1/2$  in. ( $\pm 15$  mm) over 50 ft. (15 m) from string lines.
- G. Fill gaps at the edges of the paved area with cut pavers or edge units. Do not install cut pavers smaller than one-third of a whole paver along edges subject to vehicular traffic – trim two pavers to fit.
- H. Cut all pavers using a masonry saw. Upon completion of cutting, the area must be swept clean of all debris to facilitate inspection and to ensure the concrete pavers are not damaged during compaction.
- I. Using a low amplitude plate compactor capable of at least 5,000 lbs. (22 kN) compaction at a frequency of 75 Hz –100 Hz, compact the concrete pavers into the bedding course.
- J. The pavers shall be compacted to achieve consolidation of the bedding sand and brought to level and profile by not less than three passes. Initial compaction should proceed as closely as possible following the installation of the paving units and prior to the acceptance of any traffic or application of joint filling sand.
- K. Any units that are structurally damaged during compaction shall be immediately removed and replaced.

- L. Sweep dry joint filling sand into the joints and vibrate until they are full. This will require two or three passes with the compactor. Do not compact within 3 feet (1 m) of the unrestrained edges of the paving units.
- M. All work to within 3 feet (1 m) of the laying face must be left fully compacted with sand-filled joints at the end of each day.
- N. Sweep off excess sand when the job is complete.
- O. The final surface elevations shall not deviate more than 3/8 inch (10 mm) under a 10-foot (3 m) long straightedge.
- P. The surface elevation of pavers shall be 1/8 to 1/4 inch (3 to 6 mm) above adjacent drainage inlets, concrete collars or channels.

### **3.5 AS-BUILT CONSTRUCTION TOLERANCES**

- A. Final inspection shall be conducted to verify conformance to the drawings after removal of excess joint sand. All pavements shall be finished to lines and levels to ensure positive drainage at all drainage outlets and channels.
- B. The final surface elevations shall not deviate more than +/- 3/8 inch (10 mm) under a 10-foot long straight edge.
- C. Lippage: No greater than 1/8 in. (3 mm) difference in height between adjacent pavers.

**END OF SECTION**

**SECTION 32 1713  
PARKING SAFETY CURB**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes safety curb.
- B. Precast concrete safety curb.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

**PART 2 - PRODUCTS**

**2.1 CONCRETE BUMPERS**

- A. Cement: ASTM C150, portland Type II.
- B. Concrete Materials: ASTM C33; water and sand.
- C. Reinforcing Steel: ASTM A615, 40 ksi yield grade, deformed billet bars, strength and size commensurate with precast unit design.
- D. Air Entrainment Admixture: ASTM C260.
- E. Concrete Mix: Minimum 3,000 psi, 28-day strength.
- F. Use rigid molds, constructed to maintain precast units uniform in shape, size and finish. Maintain consistent quality during manufacture.
- G. Embed reinforcing steel, and drill or sleeve for two dowels.
- H. Cure units to develop concrete quality, and to minimize appearance blemishes including non-uniformity, staining, or surface cracking.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. General: Install safety curb according to manufacturer's written instructions unless otherwise indicated.
- B. Install safety curb in bed of adhesive before anchoring.
- C. Securely anchor safety curb to pavement with hardware in each preformed vertical hole in safety curb as recommended in writing by manufacturer.

**END OF SECTION**

**SECTION 32 3119**  
**DECORATIVE METAL FENCES AND GATES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Decorative aluminum fences and gates (Pedestrian).

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete.

**1.03 REFERENCE STANDARDS**

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- B. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact); 1993 (Reapproved 2019).
- C. ASTM D3359 - Standard Test Methods for Rating Adhesion by Tape Test; 2022.
- D. CLFMI WLG 2445 - Wind Load Guide for the Selection of Line Post and Line Post Spacing; 2018.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to start of work of this section; require attendance by affected installers.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Design Calculations: For high wind load areas, provide calculations for fence panels and accessory selection as well as line post spacing and foundation details. See CLFMI WLG 2445 for line post and spacing guidance.
- D. Shop Drawings:
  - 1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
- E. Manufacturer's Installation Instructions: Indicate installation requirements, post foundation anchor bolt templates, and all other associated parts..
- F. Manufacturer's Warranty.

**1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

**1.07 DELIVERY, STORAGE AND HANDLING**

- A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

**1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty for all manufactured parts provided..

D. Finish: 10 years.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Decorative Metal Fences and Gates:
1. Alumi-Guard: [www.alumi-guard.com/sle](http://www.alumi-guard.com/sle).
  2. Ideal Aluminum Products; \_\_\_\_\_: [www.ideal-ap.com/#sle](http://www.ideal-ap.com/#sle).
  3. Knotwood, a brand of OmniMax International; \_\_\_\_: [www.knotwood.com/#sle](http://www.knotwood.com/#sle).
  4. Patriot Custom Metals DBA PalmSHIELD; \_\_\_\_\_: [www.palmshieldlouvers.com/#sle](http://www.palmshieldlouvers.com/#sle).
  5. Ultra Aluminum Manufacturing Inc; \_\_\_\_\_: [www.ultrafence.com/#sle](http://www.ultrafence.com/#sle).
  6. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 FENCES**

- A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:
- B. Electro-Deposition Coating: Multi-stage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
1. Total Coating Thickness: 2 mils, minimum.
  2. Color: As selected by Architect from manufacturer's standard range.
  3. Coating Performance: Comply with general requirements of ASTM F2408.
    - a. Adhesion: ASTM D3359 (Method B); Class 3B with 90 percent or more of coating remaining in tested area.
    - b. Impact Resistance: ASTM D2794; 60 inch pounds.
- C. Aluminum: ASTM B221.
1. Rails and Posts: 6005-T5 alloy.
  2. Extrusions for Posts and Rails: 6005-T5 alloy.
- D. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.

### **2.03 ALUMINUM FENCE**

- A. Decorative Aluminum Fence System: Provide fence meeting the Test Load and Coating Performance requirements of ASTM F2408 for Industrial class.
1. Fence Panels: 8 feet high by 6 feet long.
    - a. Panel Strength: Capable of supporting 270 pounds minimum load applied at midspan without deflection.
    - b. Attach panels to posts with manufacturer's standard panel brackets and recommended fasteners.
  2. Posts: Aluminum extrusions; 4 inches square.
  3. Rails: Extruded aluminum channels.
    - a. Double-walled aluminum U channel; outside cross-section dimensions of 1-3/4 inch square; interior guide channel forms lower limit of raceway for retaining rod.
  4. Fasteners: Manufacturer's standard stainless steel bolts, screws, and washers; factory finish fasteners to match fence.
  5. Accessories: Aluminum castings, extrusions and cold-formed strips; factory finished to match fence.
    - a. Flat post cap.
  6. Color: As selected by Architect from manufacturer's standard range.
- B. Decorative Aluminum Swing Gates:
1. Gate Panels: Manufacturer's standard decorative aluminum fence panels.
  2. Posts: Aluminum extrusions; 3 inches square.
  3. Rails and Frame: Welded aluminum extrusions; 2 inches by 3 inches.
  4. Hardware:
    - a. Latch: Manufacturer's standard mechanism; factory finished galvanized steel.
    - b. See section 08 7100 for emergency egress gate hardware.

5. Operation: Manual.
6. Color: As selected by Architect from manufacturer's standard range.
7. Size: See drawings for size of wing gates.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Set fence posts in accordance with the manufacturer recommended spacing.

#### **3.02 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From Indicated Position: 1 inch.
- C. Minimum Distance from Property Line: 6 inches.

#### **3.03 CLEANING**

- A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- B. Clean fence with mild household detergent and clean water rinse well.

#### **3.04 PROTECTION**

- A. Protect installed products until completion of project.

**END OF SECTION**

**SECTION 32 8400 – PLANTING IRRIGATION**

**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. Furnish all work and material, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with the installation of underground sprinkler system complete, as shown on drawings and/or specified herein. When the term "Contractor" is used in this section, it shall refer to the irrigation contractor.

**1.3 Applicable Standards**

- A. ASTM D2241 - Poly (Vinyl Chloride)(PVC) Plastic Pipe (SDR-PR)
- B. D2464 - Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Threaded, Schedule 40
- C. D2564 - Solvent cements for Poly (Vinyl Chloride)(PVC) Plastic Pipe and Fittings
- D. D2855 - Making Solvent - Cemented Joints with Poly (Vinyl Chloride)(PVC) Pipe and Fittings
- E. F-477 - Gasket Pocket Pipe

**1.4 WARRANTEE AND MAINTENANCE**

- A. Warrantee:
  - 1. The Contractor is required to guarantee the sprinkler irrigation system in accordance with the form below. A copy of the guarantee form shall be included in the Operations and Maintenance Manual. The guarantee form shall be on the Contractor's letterhead and contain the following information:

**GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM**

We hereby guarantee that the sprinkler irrigation system we provided to be free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear, and unusual abuse or neglect excepted. We agree to repair or replace any defects in material or workmanship including repair of backfill settlement which may develop during the period of one year from the date of Substantial Completion and to repair or replace any damage related to such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

Project: \_\_\_\_\_

Location: \_\_\_\_\_

\_\_\_\_\_

Signed: \_\_\_\_\_ (Contractor)

Address: \_\_\_\_\_

Phone: \_\_\_\_\_

Date of Acceptance: \_\_\_\_\_

- A. Maintenance
  - 1. Work shall include but not be limited to:
    - a. Adjustment of sprinkler height and plumb to compensate for settlement and/or plant growth.
    - b. Backfilling of all trenches.
    - c. Adjustment of head coverage (arc of spray) as necessary.
    - d. Unstopping heads plugged by foreign material.
    - e. Adjustment of controller as necessary to insure proper sequence and watering time.
    - f. All maintenance necessary to keep the system in good operating condition.
  - 2. Exclusions
    - a. Guarantee and maintenance after final acceptance does not include alterations as necessitated by re-landscaping, regrading, addition of trees or the addition and/or changes in sidewalks, walls, driveways, etc., except to the extent that such work is caused or necessitated by the irrigation Contractor or his general Contractor.

## 1.5 SUBMITTALS

- A. The Contractor shall submit to the Owner's Representative two (2) copies of shop drawings or manufacturer's "cut sheet" for each type of sprinkler head, pipe, controller, valves, check valve assemblies, valve boxes, wire, conduit, fittings and all other types of fixtures and equipment which he proposes to install on the job. The submittal shall include the manufacturer's name, model number, equipment capacity and manufacturer's installation recommendation, if applicable, for each proposed item.
- B. A contract will not be issued to the Contractor until he has submitted the required information. No partial submittal will be accepted and submittals shall be neatly bound into a brochure and logically organized. After the submittal has been approved, substitutions will not be allowed except by written consent of the Owner's Representative.
- C. Shop drawings
  - 1. Include dimensions, elevations, construction details, arrangements and capacity of equipment, as well as manufacturer's installation recommendations.
- D. Record Drawings
  - 1. Record dimensioned locations and depths for each of the following:
    - a. Sprinkler pressure line routing (Provide dimensions for each 100 lineal feet (maximum) along each routing, and for each change in directions).
    - b. Gate Valves, Irrigation control valves, Control wire routing, Sleeves under paving and other related items as may be directed by the Owner's Representative.
- E. Dimensioning
  - 1. Locate all dimensions from two permanent points (buildings, monuments, sidewalks, curbs or pavements).
- F. Changes
  - 1. Record all changes which are made from the Contract Drawings, including changes in the pressure and non-pressure lines.
  - 2. Record all required information on a set of blackline prints of the drawings. Do not use these prints for any other purpose.
  - 3. Maintain information daily. Keep drawings at the site at all times and available for review by the Owner's Representative.
- F. Record Drawing Submittal



1. When record drawings have been approved by the Owner's Representative, transfer all information to a set of reproducible mylars using permanent india ink.
2. Changes using ball point pen are not acceptable.
3. Make dimensions accurately at the same scale used on the original drawings, or larger.
4. If photo reduction is required to facilitate controller chart housing, notes or dimensions shall be a minimum 1/4" in size.
5. Reproducible mylars will be furnished by the Owner's Representative at cost for printing and handling.

## **1.6 CONTROLLER CHARTS**

- A. Do not prepare charts until record drawings have been approved by the Owner's Representative.
- B. Provide one controller chart for each automatic controller installed. Chart may be a reproduction of the Record Drawing, if the scale permits the chart to fit into the controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
- C. Chart shall be blackline print of the actual system showing the area covered by that controller. Identify the area of coverage of each remote control valve, using a distinct different pastel color drawn over the entire area of coverage.
- D. Following approval of charts by the Owner's Representative, they shall be sealed between two layers of 20 mil plastic sheets.
- E. Charts must be completed and approved prior to final acceptance of the irrigation system.

## **1.7 OPERATING AND MAINTENANCE MANUAL**

- A. Provide two individually bound manuals detailing operating and maintenance requirements for the irrigation system.
- B. Manuals shall be delivered to the Owner's Representative no later than 10 days prior to completion of work.
- C. Provide descriptions of all installed materials and systems in sufficient detail to permit maintenance personnel to understand, operate and maintain the equipment.
- D. Information Required
  1. Index sheet, stating the Irrigation Contractor's name, address, telephone number and name of person to contact, Duration of guarantee period, Equipment list providing the following for each item:
    - a. Manufacturer's name
    - b. Make and model number
    - c. Name and address of local manufacturer's representative
    - d. Spare parts list in detail
    - e. Detailed operating and maintenance instructions for major equipment.

## **1.8 SUBSTITUTION OF MATERIALS**

- A. This irrigation system has been designed around the irrigation components herein stated and as shown on the plans. Any changes of brand name, trade name, trademarked, patented articles, or any other substitutions will be allowed only by written order signed by the Owner's Representative. The Owner is under no obligation to accept materials other than as specified. If a bidder wishes for a substitute item to receive consideration as an approved equal, the bidder and each item must meet all the following requirements without exceptions.
  1. Criteria
    - a. An item, to be considered a substitute, must meet the same specifications of materials, fabrication or construction, dimension or size, shape, finish, performance standards, warranty or guarantee, and any other pertinent and salient features of quality, as indicated in manufacturer's specifications for the original specified item.

2. Submittal for Consideration
  - a. A sample of the item, along with a written request for consideration, shop drawings, and written specifications, must have been received by the Owner's Representative a minimum of ten (10) calendar days after bid opening date. The item shall then be examined, and the bidder shall be notified, in writing, seven (7) days later, whether or not the item is an approved equal. The Owner's Representative shall be the final judge of whether or not an item submitted for consideration qualifies as being an acceptable substitute.
  - b. Under no circumstances shall an item be given consideration as an "approved equal" substitute later than ten (10) days after the bid opening. After that date, all items shall be bid per the original specifications. Likewise, unless certified as "approved equal" per the time frame and the requirements above, the successful bidder (known as Contractor after signing the contract) shall install all items per the original plans and specifications. Equipment or material installed or furnished without prior approval of the Owner's Representative as herein specified, may be rejected and the Contractor required to remove such materials at his own expense.
  - c. The Contractor alone shall bear complete responsibility for the installation and operation of any material or equipment installed on the job (as a substitute for specified equipment or material) should such substituted material prove to be defective, inoperable or inapplicable.
3. Codes and Permits
  - a. All work under this contract shall comply with the provisions of these specifications, as illustrated on the accompanying drawings, or as directed by the Owner's Representative and shall satisfy all applicable local codes, ordinances, or regulations of the governing bodies and all authorities having jurisdiction over this project.
  - b. Installation of equipment and material shall be done in accordance with the requirements of the National Electric Code, local and national Plumbing Codes and standard plumbing procedures. The drawings and these specifications are intended to comply with the necessary rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the contractor shall immediately notify the Owners Representative in writing of the discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with the regulations shall be paid for as covered by these contract documents.
  - c. The Contractor shall give all necessary notices, obtain all permits and pay all costs in connection with his work; file with all governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver to the Owner's Representative before request for acceptance and final payment for his work.
  - d. The Contractor shall include in the work any labor, materials, services, apparatus or drawings in order to comply with all applicable laws, ordinances, rules and regulations whether or not shown on the drawings and/or specified.

## **1.9 QUALITY ASSURANCE**

- A. The installation of the irrigation system shall be made by an individual or firm duly licensed under the State of Arizona Registrar of Contractors.
  1. Superintendent: A superintendent satisfactory to the Owner's Representative shall be on in the employ of the Contractor and shall be on the site at all times while the specified herein is being performed.
  2. The superintendent shall not be changed, except with the consent of the Owner's Representative
  3. The superintendent shall be authorized to represent the Contractor.
  4. The superintendent shall have a minimum of 7 years irrigation installation experience and a minimum of 2 years supervisory experience.

#### **1.10 NOTIFICATION OF OWNER'S REPRESENTATIVE**

- A. The Owner's Representative shall have free access to the work whenever it is in preparation or progress and proper facilities for such access and inspection. The Contractor shall notify the Owner's Representative when he will and will not be on the job. Should the Contractor work periodically on the job, the Owner's Representative shall have the right to require the Contractor to give a 24 hour notice of each and every day or partial day that he intends to work on the project. The Contractor shall perform no work unless the Owner's Representative has been properly notified. Failure to notify the Owner's Representative may require the Contractor to redo, uncover pipe, expose for inspection, etc., all that the Owner's Representative was unable to inspect.

#### **1.11 EXISTING UTILITIES**

- A. Location and Elevations: The Contractor shall examine the site and verify to his own satisfaction the locations and elevations of all utilities both public and private and availability of utilities and services required. The Contractor shall inform himself as to their relation to the work and the submission of bids shall be deemed as evidence thereof. The Contractor shall repair at his own expense, and to the satisfaction of the Owner's Representative, for damage to any utility shown or not shown on the plans.
- B. Should utilities not shown on the plans be found during excavations Contractor shall promptly notify Owner's Representative for instructions as to further action.
- C. Contractor shall make necessary adjustments in the layout as may be required to connect to existing stubouts, should any such stubouts not be located exactly as shown and as may be required to work around existing work, at no increase in cost to the Owner. All such work will be recorded on record drawings and turned over to the Owner's Representative prior to final acceptance.

#### **1.12 COOPERATION**

- A. Work under this contract may be accomplished with other Contractors and trades on the project site at the same time. The Contractor shall allow each Contractor and trade adequate time at the proper stage of construction to fulfill his contract

#### **1.13 ELECTRIC POWER**

- A. Electric power to operate the controller is existing at the controller locations except as noted on the Construction Drawings. Service wiring to the controller cabinet shall be furnished by the irrigation contractor.

#### **1.14 WATER FOR TESTING**

- A. The Owner shall furnish all water necessary for testing, flushing and jetting.

#### **1.15 EXTRA EQUIPMENT**

- A. Supply as part of this contract the following tools:
  - 1. Two sets of special tools required for removing, disassembling and adjusting each type of sprinkler and valve supplied on this project.
  - 2. Two keys for the automatic controller
  - 3. Three valve box keys or wrenches.
  - 4. The above mentioned equipment shall be turned over to the Owners Representative at the conclusion of the project. Before final inspection can occur, evidence that the Owner has received this material must be shown to the Owner's Representative.

## **1.16 SLEEVES AND ELECTRICAL CONDUITS**

- A. Sleeves and electrical conduits will need to be installed as noted on the Construction Drawings. Contractor shall be responsible for timely placement of all sleeves and conduits at no additional cost to the Owner.

## **1.17 PROGRESS MEETINGS**

- A. Contractor shall attend all progress meetings as requested by the Owner's Representative during installation and as needed to keep work progressing.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL REQUIREMENTS**

- A. Unless otherwise noted on the plans, all materials shall be new and unused. This irrigation system has been designed around the irrigation components herein stated and as shown on the plan. Any changes of brand name, trade name, trademarked, patented articles, or any other substitutions will be allowed only by written order as outlined in Section 1.06.

### **2.2 EQUIPMENT**

- A. PVC Pressure Mainline Pipe Fittings
  1. Pressure mainline piping shall be PVC Schedule 40.
  2. Pipe shall be made from NSF approved type I, grade I PVC compound conforming to ASTM specification D - 2241. Piping up to and including 3" size shall be SDR solvent weld. Pressure mainline piping 4" size and larger to be gasket pocket type as manufactured by the Swanson Company or equal, and shall conform to ASTM F-477.
  3. PVC solvent weld fittings shall be Schedule 80k, Type I NSF approved conforming to ASTM test procedure D2466 (for sizes up to and including 3") and shall be as manufactured by Spears, Lasco or Dura.
  4. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be Red Hot Blue Glue and Christy's Purple Primer. Manufacturer's installation requirements shall be strictly adhered to.
  5. All PVC pipe shall bear the markings showing the Manufacturer's name, Nominal pipe size, Schedule or class, Pressure rating in psi, National Sanitation Foundation (NSF) approval and Date of extrusion.
  6. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable IPS schedule and NSF seal of approval.
- B. PVC Non-Pressure Lateral Piping
  1. Non-pressure buried lateral line piping shall be PVC class 200 with solvent weld joints for sizes 3/4" and greater.
  2. Pipe shall be made from NSF approved, Type I, Grade II PVC compound conforming to ASTM resin specifications D1784. All pipe shall meet requirements set forth in Federal Specification PS-22-70, for the appropriate standard dimension ratio (SDR).
  3. PVC Solvent weld fittings shall be Schedule 40, Type I NSF approved conforming to ASTM test procedure D2466 as manufactured by Spears, Lasco or Dura.
- C. Galvanized Pipe & Fittings
  1. Where indicated on the drawings and on the details, use galvanized steel pipe ASA Schedule 40 mild steel screwed pipe.
  2. Fittings shall be medium galvanized screwed beaded malleable iron. Galvanized couplings may be merchant coupling.

3. All galvanized pipe and fittings installed below grade shall be painted with two coats of Koppers # 50 Bitumastic (except swing joint assembly).
- D. Backflow Preventer
1. Backflow Preventer shall be a reduced pressure type of the size shown on the project plans.
- E. Gate Valves
1. Brass ball valve similar to those manufactured by Champion.
- F. Valve Boxes
1. A box shall be provided for all valves and equipment as detailed on the project plans. Valve boxes shall be made of high-strength, plastic suitable for turf irrigation purposes. Boxes shall be suitable in size and configuration for the operability and adjustment of the valve. Extension sections will be used as appropriate to the depth of piping. All valve box covers shall bolt down and shall be colored Purple to indicate reclaimed water and imprinted "Irrigation".
  2. Boxes for valves shall have a locking or bolt down cover. Box shall be as manufactured by Ametek or approved equal. Only one remote control valve/gate valve assembly shall be installed per valve box. Box shall be rectangular in shape and be sufficiently large to allow easy access, maintenance and repair of the equipment contained therein.
- G. Quick Coupling Valves and Wire Splices
1. Box shall be a 10" diameter round, plastic valve box.
- H. Electric Control Valves
1. Valve shall be of size indicated on Drawings Valves shall be the Irritrol 700.
- I. Control Wire
1. Control wire shall be UF-UL listed, color coded copper conductor direct burial size 14. Tape control wires to side of main line every 10 feet. Where control wire leaves main or lateral line, bury a minimum of 24" deep. Use 3M DBY waterproof wire connectors at splices and locate all splices within valve boxes. Use white or gray color for common wire and other colors for all other wire. Each common wire may serve only one controller. Do not use black on any 24V circuit. One extra control wire shall be run from panel continuously from valve to valve throughout system controlled by that controller, similar to common wire for use if a wire fails. Wire shall be different color than all other wires, shall not be green, and shall be marked in control box as an extra wire.
- J. Irrigation Controller
1. Electric and Battery Automatic Controllers shall be: Rainbird ESP-LXME 12
- K. Pressure Regulator
1. Self contained, single seat, direct acting, spring loaded, diaphragm actuated type. The valve body shall be of all brass construction, stainless steel body seat, composition seat discs, BUNA-N diaphragm with nylon insert and stainless steel springs. The valve shall have a maximum working pressure rating of 150 psi and shall be capable of regulating outlet pressure from 5 to 30 psi and have an adjustment for setting the pressure. The downstream pressure variance shall not exceed a rate of 0.454 psi for every 10 psi variance in upstream or source pressure. The valve shall have an integral "Shrader" pressure test valve.
- L. Filters
1. Filters used down stream of the Remote Control Valves shall be a Y strainer type with minimum of 200 mesh filtration. The filter shall have a threaded opening to allow attachment of a hose for flushing. The filter shall have features similar to the Rainbird RBY-100-150MX.
- M. Moisture Sensor
1. The moisture sensor be wired to valve solenoid. The moisture Sensor shall have features similar to the Rainbird SMRT-Y.
- O. Emitter Assembly
1. Emitters shall be of the pressure compensating, self-flushing type.

2. The cases of the emitters shall be made of durable black, heat resistant acetal plastic material. It shall be resistant to temperature variation, ultraviolet radiation, smog (ozone), common liquid fertilizer and weed spray.
  3. The emitter shall be capable of continuous, clog free operation with 140 mesh (minimum) filtration. The emitter shall be capable of being installed in any position and maintain its given flow characteristics. The emitter shall be non adjustable.
  4. The emitter shall function with a system pressure range of 15 psi minimum to 50 psi maximum. The emitters shall be available in flow ranges from .85 to 2.0 gph.
  5. The emitter assemblies as shown on the plans shall consist of the emitter and .22" OD spaghetti distribution tubing which shall not exceed 8" in length.
  6. Trees shall be irrigated with multi-port 1 or 2 gph/port, six ports per tree pending of species. Refer to Emitter schedule for required gallons per minute (see plans).
- P. Emitter Hose
1. The flexible emitter hose, which shall deliver water to the emitter assembly shall be manufactured from virgin polyethylene material having the following physical characteristics:
 

O.D.	.704"
I.D.	.600 min.
Wall	.0052"
Carbon Black	1.5 - 3.5
Density	.92 - .93
Melt/Environmental Stress/Crack Resistance	0/100/100
  2. Fittings for use with the emitter hose shall be of the compression, internal barb type, constructed of virgin PVC or glass-filled polypropylene materials, and as detailed on the project plans.
- Q. Sleeves
1. Provide where shown on the drawings and specified herein.
  2. All mainlines, lateral line piping, emitter headers and lateral piping and all control wire shall be installed in a sleeve under all paving, walls and concrete surfaces.
  3. All sleeving shall be SCH 40 PVC solvent weld pipe.
  4. All joints shall be solvent welded.
  5. All sleeves shall be installed as detailed on the project plans.
  6. All sleeves shall extend a minimum of 18" beyond the edge of the item being sleeved.
  7. Each sleeve shall be taped along its entire length with metallic locator tape manufactured for that purpose.
  8. Sleeves shall have a minimum horizontal clearance of 12" from each other and other piping. Sleeves shall not be installed parallel and directly over another line. Sleeves shall have a minimum of 9 inches vertical clearance where they cross other lines.
- R. Other equipment:
1. Other Components shall be as recommended by Manufacturer and subject to Architect's review and acceptance and as necessary to complete and make system operational.

## PART 3 – EXECUTION

### 3.1 GENERAL

- A. Contractor Responsibility: The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in equipment usage, area dimensions or static water pressure exist that might not have been considered in the engineering. Such obstructions or differences shall be brought to the attention of the Owner's Representative. In the event this notification is not performed, the Contractor shall assume full responsibility for any revision necessary.
- B. All material and equipment shall be delivered to the job site in unbroken reels, cartons or other packaging to demonstrate that such material is new and of a quality and grade in keeping with the intent of these specifications.

### **3.2 SITE CONDITIONS**

- A. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions and receive the Owner's Representative's approval prior to beginning work.
- B. Contractor shall be responsible for layout of all equipment and piping in the irrigation system. This layout shall be in conformance with notations on the Construction Drawings.
- C. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damage to utilities which are caused by his operation or neglect. Contractor shall check existing utility drawings and contact Bluestake prior to any excavation.
- D. Coordinate installation of irrigation materials, including pipe so there shall be no interference with utilities or other construction or difficulty in planting trees, shrubs and ground covers. Contractor shall coordinate with other trades to insure timely placing of necessary sleeves, wires and pipes under walks, curbs and paving.
- E. Design Pressure: This irrigation system has been designed to operate with a minimum static inlet water pressure as shown on the drawings. The Contractor shall take a pressure reading prior to beginning construction. If the pressure reading is less than indicated, the Contractor shall notify the Owner's Representative.

### **3.3 PREPARATION**

- A. Prior to installation, the Contractor shall stake out all pressure supply lines, location of remote control valves, sprinkler heads, controllers, backflow preventers, gate valves, quick coupling valves and other irrigation equipment.
- B. All layout shall be approved by the Owner's Representative prior to installation. Prior approval shall be obtained for valves, controllers, main line routing, quick coupling valves, backflow preventers, water meters and sprinkler locations.

### **3.4 WATER SUPPLY**

- A. Irrigation system shall be connected to the new water mainline at the approximate location shown on the drawings. Contractor is responsible for minor changes caused by actual site conditions and tap locations.

### **3.5 EXCAVATION AND BACKFILL**

- A. Trenching
  - 1. Dig trenches straight and support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall follow the layout as approved by the Owner's Representative in the field. If the bottom of a pipe trench excavation is found to consist of rock, caliche, or any other material that, because of its hardness or sharpness, cannot be excavated to give a uniform bearing surface, said rock or other material shall be removed for at least three (3) inches below the specified trench depth and refilled to the specified trench depth with sand or other approved shading material.
- B. Burial of Pipe
  - 1. Depth of Pipe shall be as shown on the construction details
- C. Backfilling
  - 1. The trenches shall not be backfilled until all the required tests are performed. Trenches shall be carefully backfilled in 8" lifts with the excavated materials, less any stone or clods of earth larger than 1/2" in any dimension. Backfill shall be mechanically compacted in landscape areas to a dry density equal to adjacent undisturbed soil. Backfill shall conform to adjacent grades without dips, sunken areas, humps or other surface irregularities. Backfilling shall not be performed while trenches or backfill material is in a wet or muddy condition.

2. A fine granular material backfill will be initially placed on all lines to a depth of 3" over the top of the pipe. No foreign matter or particles larger than 1/2" in any one dimension will be permitted in this backfill. Existing site soil that conforms to this gradation requirement may be used for this initial backfill.
  3. Flooding of trenches will be permitted only with approval of the Owner's Representative.
  4. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments without cost to the owner. Contractor shall also make repairs or replacements to any item damaged by settlement of trenches or irrigation equipment, whether said item was part of the original scope of construction or not.
- D. Trenching and backfill under paving
1. Trenches located under areas where paving, asphaltic concrete or concrete will be installed shall be backfilled with sand for a depth of 3" below the bottom of the pipe (or sleeve) and 3" above the top of the pipe (or sleeve). and compacted to 90% compaction or the required subgrade compaction for that area (whichever is greater), using manual or mechanical tamping devices. All trenches shall be left flush with the adjoining grade. The Contractor shall set in place, cap, and pressure test all piping under paving prior to the paving work.
  2. Provide for a minimum cover of 18" between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.
- E. Assemblies
1. Routing of sprinkler irrigation lines as indicated on the drawings is diagrammatic. Install lines and various assemblies to conform with the details shown on drawings and in accordance with the manufacturer's recommendations.
  2. Install no multiple assemblies on plastic lines. Provide each assembly with its own outlet.
  3. Install all assemblies specified herein in accordance with respective detail. In absence of detail drawings or specifications pertaining to specific items required to complete work, perform such work in accordance with best standard practice with the prior approval of the Owner's Representative.
  4. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent-welding methods shall be recommended by the pipe and fitting manufacturer. Primer shall be used on all solvent weld joint. No solvent weld joint shall be submitted to water pressure until curing for 24 hours minimum.
  5. On PVC to metal connections, the Contractor shall work the metal connections first. Teflon paste shall be used on all threaded PVC to PVC joints, and on all threaded PVC to metal joints. Light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters into which the pipe may be welded. Teflon tape shall not be accepted.
  6. Gasket pocket pipe and fittings shall be assembled in strict accordance with the manufacturer's recommendations. Only recommended lubricant will be permitted.
- F. Concrete thrust blocks
1. Installed at specific locations per manufacturer's recommendations and instructions. Thrust blocks shall be installed for main lines at all changes in direction, tees, and gate valves.
- G. PVC Pipe Installation:
1. Piping shall be snaked in the trench to allow for thermal expansion and contraction.
  2. After all curing of solvent weld joints and after having received the approval of the Owner's Representative, the mainline shall be filled. Extreme care will be taken to slowly fill the piping while releasing entrapped air at the ends of the main line.
  3. All lines shall have a minimum clearance of six inches from each other, and from lines of other trades. This clearance shall not supersede any clearance required by local, regional or national building, health or safety codes. Parallel lines shall not be installed directly over one another.
  4. Manufacturer's installation recommendations shall be strictly adhered to.
- H. Flushing of System



1. After all new sprinkler pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of sprinkler, heads, the control valves shall be opened and a full head of water used to flush out the system.
  2. Sprinkler shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the Owner's Representative.
- I. Temporary Repairs
1. The Owner reserves the right to make temporary repairs as necessary to keep the sprinkler system equipment in operating condition. The exercise of this right by the Owner's Representative shall not relieve the Contractor of his responsibilities under the terms of the guarantee as herein specified.
- J. Pressure Regulator
1. Install in a valve box in conformance with the project details.
- K. Emitter Assembly
1. The emitter and distribution tubing shall be assembled using the manufacturer's recommended tools and accessories.
  2. The maximum length of the .22" distribution tubing shall be 8'. In the event the distance in the field exceeds the maximum length, the Contractor shall extend the poly tubing as required by adding a tee and shall add a hose end cap to this extension at the Contractor's expense.
  3. The Contractor shall assemble the emitter assembly in conformance with the applicable detail on the project plans. This detail will depend on whether the emitter is irrigating a tree in turf or other ground plane material.
- L. Emitter Hose
1. The emitter hose location, as shown on the plans, is diagrammatic. The Contractor shall layout this hose so as to conform to the maximum distance requirements as specified under the emitter assembly section of these specifications.
  2. The Contractor shall flush the emitter hose prior to and after installation of the emitter assemblies.

### 3.6 FIELD QUALITY CONTROL

- A. Adjustment of the system
1. The Contractor shall flush and adjust all sprinkler heads for optimum performance and to prevent, as much as possible, over spray into walks, roadways and buildings.
  2. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, the Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required. Such changes shall be approved in advance by the Owner's Representative, at no cost to the Owner.
  3. Lowering raised sprinkler heads by the Contractor shall be accomplished within 10 days after notification by the Owner.
  4. All sprinkler heads shall be set perpendicular to finished grades unless otherwise designated on the plans. On slopes, heads shall be angled for optimum coverage and performance.
  5. Owner's Representative to approve all head locations and reserves the right to request the contractor to make minor adjustments to head placement or nozzle selection at no cost to the Owner.
  6. All parts of the irrigation system and associated equipment shall be adjusted to function properly and shall be turned over to the Owner in operating condition.
- B. Testing of the Irrigation System
1. The Contractor shall request the presence of the Owner's Representative at least 48 hours in advance of testing.
  2. Test all pressure lines under hydrostatic pressure of 150 lbs. per square inch and prove water tight.

3. All piping under paved areas shall be tested under hydrostatic pressure of 150 lbs. per square inch and proved water tight prior to paving.
4. All PVC lateral line pipe shall be tested at working line pressures with coupling exposed and swing joints and other outlets capped.
5. Sustain pressure in the lines for not less than two hours. Pipe sections shall be center loaded and all coupling shall be exposed. Before testing, the line shall have been filled with water for at least four (4) hours and provisions made for thoroughly bleeding the line of air.
6. All hydrostatic tests shall be made only in the presence of the Owner's Representative. No pipe shall be backfilled until it has been inspected, tested and approved in writing.
7. Furnish necessary force pump and all other equipment necessary to perform test.
8. When the sprinkler irrigation system is completed, perform a coverage test in the presence of the Owner's Representative to determine if the water coverage for the planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate without bringing this to the attention of the Owner's Representative. This test shall be accomplished before any planting or turf has been installed.
9. Upon completion of each phase of work, entire system shall be tested and adjusted to meet site requirements.

### **3.7 MAINTENANCE**

- A. The entire irrigation system shall be under full automatic operation for a period of seven days prior to planting.
- B. The Owner's Representative reserves the right to waive or shorten this operation period.
- C. Contractor shall provide job maintenance of the entire irrigation system and shall continue until job acceptance by the Owner. Maintain all system components and assure proper watering of all plants. Repair all leaks and replace any defective components. After all landscape and irrigation operations are complete and in conformance with the contract documents, the Owner shall grant provisional acceptance.
- D. Following provisional acceptance, the Contractor shall provide job maintenance for 90 days consisting of all items covered under maintenance. Following the 90 day maintenance period, the Owner shall grant final job acceptance after verifying all work and system components are in conformance with the Contract Documents.

### **3.7 CLEANUP**

- A. Cleanup shall be made as each portion of work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained to the work of others shall be repaired to the original conditions acceptable to the Owner's Representative.

### **3.8 FINAL OBSERVATION PRIOR TO ACCEPTANCE**

- A. The Contractor shall operate each system in its entirety for the Owner's Representative at the time of final observation. Any items deemed not acceptable shall be reworked to the complete satisfaction of the Owner's Representative.
- B. The Contractor shall show evidence to the Owner's Representative that the owner has received all accessories, charts, record drawings, and equipment as required before final observation can occur.

### **3.10 OBSERVATION SCHEDULE**

- A. Contractor shall be responsible for notifying the Owner's Representative in advance for the following observations according to the time indicated:
  - Pre-job conference - 7 days
  - Pressure supply line installation and testing - 48 hours
  - Automatic controller installation - 48 hours
  - Control wire installation - 48 hours
  - Lateral line and sprinkler installation - 48 hours
  - Coverage test - 48 hours
  - Final observation - 7 days
- B. When the inspections have been conducted by other than the Owner's Representative, show evidence and by whom these inspections were made.
- C. No observation shall commence without as-built drawings.
  - 1. In the event the Contractor calls for an observation without as-built drawings, without completing previously noted corrections, or without preparing the system for observations, he shall be responsible for reimbursing the Owner's Representative at the hourly rate in effect at the time of the observation, portal to portal (plus transportation cost) for the inconvenience. No further inspections will be scheduled until this charge has been made. Delays in schedules caused by Contractor's non-payment of these charges shall not be grounds for extension of the construction schedule.

**END OF SECTION**

## SECTION 329113 - SOIL PREPARATION

### 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 planting soils specified by composition of the mixes.
- B. Related Requirements:
  1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
  2. Section 329200 "Turf and Grasses" for placing planting soil for turf and grasses.
  3. Section 329300 "Plants" for placing planting soil for plantings.

#### 1.3 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
- C. CEC: Cation exchange capacity.
- D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
- F. Imported Soil: Soil that is transported to Project site for use.
- G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.
- H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.
- I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through inter laboratory sample exchanges and statistical evaluation of analytical data.

- J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."
- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- M. SSSA: Soil Science Society of America.
- N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- Q. USCC: U.S. Composting Council.

#### **1.4 PREINSTALLATION MEETINGS**

- A. Pre-installation Conference: Conduct conference at projectsite.

#### **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include recommendations for application and use.
  - 2. Include test data substantiating that products comply with requirements.
  - 3. Include sieve analyses for aggregate materials.
  - 4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:
    - a. Manufacturer's qualified testing agency's certified analysis of standard products.
    - b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
    - c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.
- B. Samples: For each bulk-supplied material, 1-quart volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

## **1.6 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For each testing agency.
- B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.
- C. Field quality-control reports.

## **1.7 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.
  - 1. Multiple Laboratories: At Contractor's option, work may be divided among qualified testing laboratories specializing in physical testing, chemical testing, and fertility testing.

## **1.8 PRECONSTRUCTION TESTING**

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil and imported soil.
  - 1. Notify Architect seven days in advance of the dates and times when laboratory samples will be taken.
- B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
  - 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

## **1.9 SOIL-SAMPLING REQUIREMENTS**

- A. General: Extract soil samples according to requirements in this article.
- B. Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of Architect under the direction of the testing agency.
  - 1. Number and Location of Samples: Minimum of three representative soil samples from varied locations for each soil to be used or amended for landscaping purposes.
  - 2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
  - 3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
  - 4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

## 1.10 TESTING REQUIREMENTS

- A. General: Perform tests on soil samples according to requirements in this article.
- B. Physical Testing:
  - 1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
    - a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
    - b. Hydrometer Method: Report percentages of sand, silt, and clay.
  - 2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
  - 3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
  - 4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).
- C. Chemical Testing:
  - 1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
  - 2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
  - 3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
  - 4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.
- D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT NCR-13 including the following:
  - 1. Percentage of organic matter.
  - 2. CEC, calcium percent of CEC, and magnesium percent of CEC.
  - 3. Soil reaction (acidity/alkalinity pH value).
  - 4. Buffered acidity or alkalinity.
  - 5. Nitrogen ppm.
  - 6. Phosphorous ppm.
  - 7. Potassium ppm.
  - 8. Manganese ppm.
  - 9. Manganese-availability ppm.
  - 10. Zinc ppm.
  - 11. Zinc availability ppm.
  - 12. Copper ppm.
  - 13. Sodium ppm

14. Soluble-salts ppm.
  15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
  16. Other deleterious materials, including their characteristics and content of each.
- E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
- F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

### **1.11 DELIVERY, STORAGE, AND HANDLING**

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
  2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  3. Do not move or handle materials when they are wet or frozen.
  4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Regional Materials: Imported soil and soil amendments and fertilizers shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

### **2.2 INORGANIC SOIL AMENDMENTS**

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
  2. Class: O, with a minimum of 95 percent passing through a No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
  3. Form: Provide lime in form of ground dolomitic limestone.



- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Perlite: Horticultural perlite, soil amendment grade.
- E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.
- F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

### **2.3 ORGANIC SOIL AMENDMENTS**

- A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
  - 1. Feedstock: May include animal waste
  - 2. Reaction: pH of 5.5 to 8
  - 3. Soluble-Salt Concentration: Less than 4 dS/m.
  - 4. Moisture Content: 35 to 55 percent by weight.
  - 5. Organic-Matter Content: 30 to 40 percent of dryweight.
  - 6. Particle Size: Minimum of 98 percent passing through a 4-inch sieve.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.
- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 6 to 7.5, a soluble-salt content measured by electrical conductivity of maximum 5 dS/m, having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.
- D. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
  - 1. Partially Decomposed Wood Derivatives: In lieu of shredded and composted wood derivatives, mix shredded and partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

## **2.4 FERTILIZERS**

- A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
  - 1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
  - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.
- C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
  - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.
- D. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Place planting soil and fertilizers according to requirements in other Specification Sections.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
- C. Proceed with placement only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING**

- A. Excavation: Excavate soil from designated area(s) to a depth of 6 inches and stockpile until amended.
- B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
- C. Unsuitable Materials: Clean soil to contain a maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarsesand.
- D. Screening: Pass unamended soil through a 2-inch sieve to remove large materials.

### **3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE**

- A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Subgrade Preparation: Till subgrade to a minimum depth of 18 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
  - 1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.
- C. Mixing: Spread unamended soil to total depth of 12 inches but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
  - 1. Amendments: Apply soil amendments, except compost, and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.
    - a. Mix lime and sulfur with dry soil before mixing fertilizer.
    - b. Mix fertilizer with planting soil no more than seven days before planting.
  - 2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 12 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- D. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place except where a different compaction value is indicated on Drawings.
- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

### **3.4 APPLYING COMPOST TO SURFACE OF PLANTING SOIL**

- A. Application: Apply compost component of planting-soil mix 4 inches of compost to surface of in-place planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Finish Grading: Grade surface to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

### **3.5 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests:
  - 1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on

laboratory testing according to ASTM D 698. Space tests at no less than one for each 2000 sq. ft. of in-place soil or part thereof.

- C. Soil will be considered defective if it does not pass tests.
- D. Prepare test reports.
- E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

### **3.6 PROTECTION**

- A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."
- B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Parking vehicles or equipment.
  - 3. Vehicle traffic.
  - 4. Foot traffic.
  - 5. Erection of sheds or structures.
  - 6. Impoundment of water.
  - 7. Excavation or other digging unless otherwise indicated.
- C. If planting soil or subgrade is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

### **3.7 CLEANING**

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
  - 1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

**END OF SECTION**

## SECTION 32 9300 - PLANTS

### 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. Plants.
  - 2. Tree stabilization.
  - 3. Tree-watering devices.
  - 4. Landscape edgings.
  - 5. Tree grates.
  - 6. Mushing.
  - 7. Stabilized Decomposed Granite.
- B. Related Requirements:
  - 1. Section 015639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
  - 2. Section 329200 "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.

#### 1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed

from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

- F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- G. Finish Grade: Elevation of finished surface of planting soil.
- H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- J. Planting Area: Areas to be planted.
- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" for drawing designations for planting soils.
- L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- M. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

#### **1.4 COORDINATION**

- A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
  - 1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.
- B. Stabilized Decomposed Granite: Decomposed Granite ¼" screened aggregate paving with stabilizer additive.
  - 1. Tests: Perform gradation of decomposed granite material in accordance with ASTM C 136 – Method for Sieve Analysis for Fine and Course.
  - 2. Mock Ups: Install 4ft x 10ft wide mockup of decomposed granite paving with stabilizer additive at location as directed by Landscape Architect or Owner's Representative.

## **1.5 PREINSTALLATION MEETINGS**

- A. Pre-installation Conference: Conduct conference at projectsite.

## **1.6 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
- B. Samples for Verification: For each of the following:
  - 1. Trees and Shrubs: Three Samples of each variety and size delivered to site for review. Maintain approved Samples on-site as a standard for comparison.
  - 2. Organic Mulch: 1-pint volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organicmakeup.
  - 3. Mineral Mulch: 5 lb of mineral mulch (Decomposed Granite ¾" Screened) required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on-site; provide an accurate indication of color, texture, and makeup of the material.
  - 4. Stabilized Decomposed Granite: 5lb sample and sieve analysis for grading of Decomposed Granite ¼" Screened Aggregate, required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on-site; provide an accurate indication of color, texture, and makeup of the material.
  - 5. Weed Control Barrier: 12 by 12 inches.
  - 6. Proprietary Root-Ball-Stabilization Device: One unit.
  - 7. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.
  - 8. Root Barrier: Width of panel by 12 inches.

## **1.7 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
  - 1. Manufacturer's certified analysis of standard products.
  - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.
- D. Sample Warranty: For special warranty.

## 1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

## 1.9 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
  - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
  - 2. Experience: Five years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
  - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  - 4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
    - a. Landscape Industry Certified Technician - Exterior.
    - b. Landscape Industry Certified Interior.
    - c. Landscape Industry Certified Horticultural Technician.
  - 5. Pesticide Applicator: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
  - 1. Selection of plants purchased under allowances is made by Architect, who tags plants at their place of growth before they are prepared for transplanting.
- C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
  - 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
  - 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- D. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
  - 1. Notify Landscape Architect of sources of planting materials fourteen (14) days in advance of delivery to site.



## 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
- B. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
  - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  - 3. Accompany each delivery of bulk materials with appropriate certificates.
- C. Deliver bare-root stock plants within 24 hours of digging. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.
- D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- E. Handle planting stock by root ball.
- F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.
- G. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
  - 1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
- H. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- I. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
  - 1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
  - 2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
  - 3. Do not remove container-grown stock from containers before time of planting.
  - 4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

## **1.11 FIELD CONDITIONS**

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

## **1.12 WARRANTY**

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
    - b. Structural failures including plantings falling or blowing over.
    - c. Faulty performance of tree stabilization and edgings.
    - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Periods: From date of Substantial Completion.
    - a. Trees, Shrubs, Vines, and Ornamental Grasses: 18 months.
    - b. Ground Covers, Biennials, Perennials, and Other Plants: 18 months.
    - c. Annuals: Six months.
  - 3. Include the following remedial actions as a minimum:
    - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
    - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
    - c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
    - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

## **PART 2 - PRODUCTS**

### **2.1 PLANT MATERIAL**

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock,

densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
  2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.
- E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.
- F. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

## **2.2 FERTILIZERS**

- A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
1. Size: 21-gram tablets.
  2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

## **2.3 MULCHES**

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
1. Type: Wood and bark chips
  2. Size Range: 3 inches maximum, 1/2 inch minimum
  3. Color: Natural.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch sieve; soluble-salt content of 2 to 5 dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
  2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- C. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of the following type, size range, and color:
1. Type: Decomposed Granite
  2. Size Range: 1/2 inch Screened
  3. Color: Apache Gold or color range acceptable to Landscape Architect
- D. Stabilized Decomposed Granite:
1. Type: Decomposed Granite
  2. Size Range: 1/4" Screened
  3. Color: Express Rose or color range acceptable to Landscape Architect.
    - a. Acceptable local Suppliers:
      - 1) AAA Landscape
      - 2) Kalamazoo Construction
      - 3) Grey Rock

## **2.4 STABILIZER BINDER**

- A. Patented, non-toxic, organic binder that is a colorless and odorless concentrated powder that binds decomposed granite together to produce a firm surface.
- B. Provided by Stabilizer Solutions, Inc. 1-800-336-2468 or approved equal.

## **2.5 WEED-CONTROL BARRIERS**

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally encountered chemicals, alkalis, and acids.
- B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd.

## **2.6 PESTICIDES**

- A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

## **2.7 TREE-STABILIZATION MATERIALS**

### **A. Trunk-Stabilization Materials:**

1. Upright and Guy Stakes: 2-by-2-inch nominal by 8'-0" Fir or or 2" diameter 8'-0" long Lodgepole Pine, pointed at one end. Stakes shall be rough-sawn, sound, new and free of knots, holes, cross grain, and other defects,
2. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter with new rubber hose or strap to protect tree.
3. Guy Cables: Five-strand, 3/16-inch diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.

### **B. Root-Ball Stabilization Materials:**

1. Upright Stakes and Horizontal Hold-Down: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated; stakes pointed at one end.
2. Wood Screws: ASME B18.6.1.

## **2.8 LANDSCAPE EDGINGS**

### **A. Steel Edging: Standard commercial-steel edging, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.**

1. Edging Size: 1/4 inch thick by 5 inches deep.
2. Stakes: Tapered steel, a minimum of 12 inches long.
3. Accessories: Standard tapered ends, corners, and splicers.
4. Finish: Unfinished

## **2.9 MISCELLANEOUS PRODUCTS**

### **A. Root Barrier: Black, molded, modular panels 18 inches deep, 85 mils thick, and with vertical root deflecting ribs protruding 3/4 inch out from panel surface; manufactured with minimum 50 percent recycled polyethylene plastic with UV inhibitors.**

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

#### **A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.**

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

### **3.3 PLANTING AREA ESTABLISHMENT**

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."
- B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

### **3.4 EXCAVATION FOR TREES AND SHRUBS**

- A. Planting Pits and Trenches: Excavate circular planting pits.
  - 1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
  - 2. Excavate approximately three times as wide as ball diameter for balled and burlapped or container-grown stock.
  - 3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
  - 4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
  - 5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
  - 6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
  - 7. Maintain supervision of excavations during working hours.

8. Keep excavations covered or otherwise protected after working hours.
  9. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.
- B. Backfill Soil: Subsoil and topsoil removed from excavations may not be used as backfill soil unless otherwise indicated.
  - C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
    1. Hardpan Layer: Drill 6-inch diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.
  - D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
  - E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

### **3.5 TREE, SHRUB, AND VINE PLANTING**

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
  1. Backfill: Mixed Planting Soil
  2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
    - a. Quantity: Add Fertilizer tablets in plant pit as follows:
      - 1) One Gallon Shrubs – 1 tablet
      - 2) Five Gallon Shrub/Tree – 3 tablets
      - 3) 15 Gallon Tree – 4 tablets
  5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Balled, Potted and Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: Mixed Planting soil
  2. Carefully remove root ball from container without damaging root ball or plant.
  3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
    - a. Quantity: Add Fertilizer tablets in plant pit as follows:
      - 1) One Gallon Shrubs – 1 tablet
      - 2) Five Gallon Shrub/Tree – 3 tablets
      - 3) 15 Gallon Tree – 4 tablets
  5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

### **3.6 TREE, SHRUB, AND VINE PRUNING**

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.
- C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

### **3.7 TREE STABILIZATION**

- A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:
  1. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend to the dimension indicated on Drawings above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
  2. Upright Staking and Tying: Stake trees with two stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; three stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.
  3. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
  4. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.



### **3.8 ROOT-BARRIER INSTALLATION**

- A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise indicated on Drawings.
- B. Align root barrier vertically, and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.
- C. Install root barrier continuously for a distance of 60 inches in each direction from the tree trunk, for a total distance of 10 feet per tree. If trees are spaced closer, use a single continuous piece of root barrier.
  - 1. Position top of root barrier flush with finish grade.
  - 2. Overlap root barrier a minimum of 12 inches at joints.
  - 3. Do not distort or bend root barrier during construction activities.
  - 4. Do not install root barrier surrounding the root ball of tree.

### **3.9 PLACING SOIL IN PLANTERS**

- A. Place a layer of drainage gravel at least 4 inches thick in bottom of planter. Cover bottom with filter fabric and wrap filter fabric 4 inches up on all sides. Duct tape along the entire top edge of the filter fabric, to secure the filter fabric against the sides during the soil-filling process.
- B. Fill planter with planting Mixed Planting Soil. Place soil in lightly compacted layers to an elevation of 1-1/2 inches below top of planter, allowing natural settlement.

### **3.10 GROUND COVER AND PLANT PLANTING**

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on drawings in even rows with triangular spacing.
- B. Use Mixed Planting Soil for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

### **3.11 PLANTING AREA MULCHING**

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches secure seams with galvanized pins.

- B. Mulch backfilled surfaces of planting areas and other areas indicated with Mineral Mulch (Decomposed Granite - 1/2 inch minus) as indicated on drawings to depth of 3 inches.

### **3.12 EDGING INSTALLATION**

- A. Steel Edging: Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches apart, driven below top elevation of edging.
- B. Mow-Strip Installation:
  - 1. Excavate for mow strip as indicated on drawings.
  - 2. Compact subgrade uniformly beneath mow strip.
  - 3. Apply nonselective, pre-emergent herbicide that inhibits growth of grass and weeds.
  - 4. Install steel edging, delineating the edge of mow strip.
  - 5. Install weed-control barrier before mulching, covering area of mow strip, and overlapping and pinning edges of barrier at least 6 inches and according to manufacturer's written instructions.
  - 6. Place indicated thickness of mineral mulch, fully covering weed barrier.
  - 7. Rake mulch to a uniform surface level with adjacent finish grades.

### **3.13 STABILIZED DECOMPOSED GRANITE INSTALLATION**

- A. Blending Stabilizer:
  - 1. Blend 12-16 lbs. of stabilizer per ton of decomposed granite. It is critical that stabilizer be thoroughly and uniformly mixed throughout decomposed granite.
- B. Placement Of Decomposed Granite:
  - 1. Upon thorough moisture penetration, compact aggregate screenings to 95% relative compaction by compaction equipment such as: double drum roller (2-4 ton), single drum roller (1000 lbs.), or vibratory plate tamp.
  - 2. Do not begin compaction for 6 hours after placement and up to 48 hours. Take care in compacting decomposed granite when adjacent to planting and irrigation systems.
- C. Repairs and Protection:
  - 1. Remove and replace stabilized decomposed granite paving that is damaged, defective or does not meet the requirements of this section.

### **3.14 PLANT MAINTENANCE**

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

### **3.15 PESTICIDE APPLICATION**

- A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

### **3.16 REPAIR AND REPLACEMENT**

- A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.
  - 1. Submit details of proposed pruning and repairs.
  - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
  - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
- C. Repairs of Stabilized Decomposed Granite paving.
  - 1. Excavate damaged area to the depth of the stabilized aggregate and square up sidewalls.
  - 2. If area is dry, moisten damaged portion lightly.
  - 3. Pre-blended aggregate and stabilizer powder with the proper amount of aggregate in a concrete mixer.
  - 4. Add water to the pre-blended aggregate and stabilizer. Thoroughly moisten mix with 25 to 35 gallons per ton of pre-blended material or to approximately 10% moisture content.
  - 5. Apply moistened pre-blended aggregate to excavated area to finish grade.
  - 6. Compact with an 8" to 10" hand tamp or 250 to 300 lb. roller (if area is high traffic such as cart path, driveway or parking lot, use a larger 1000 lb. roller). Keep traffic off areas for 12 to 48 hours after repair has been completed.

### **3.17 CLEANING AND PROTECTION**

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

- B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.
- C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- D. After installation and before Substantial Completion remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.
- E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

### **3.18 MAINTENANCE SERVICE**

- A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
  - 1. Maintenance Period: 18 months from date of Substantial Completion.
- B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
  - 1. Maintenance Period: 18 months from date of Substantial Completion.
- C. Maintenance of Stabilized Decomposed Granite:
  - 1. Remove debris, such as paper, grass clippings, leaves or other organic material by mechanically blowing or hand raking the surface as needed.
  - 2. During the first year, a minor amount of loose aggregate will appear on the surface (1/16 to 1/4 inch). If this material exceeds a 1/4 inch, redistribute the material over the entire surface. Water thoroughly to the depth of 1". Compact with power roller of no less than 1000 lbs. This process should be repeated as needed.
  - 3. If cracking occurs, simply sweep fines into the cracks, water thoroughly and hand tamp with an 8" to 10" hand tamp plate
  - 4. Maintenance Period: 18 months from date of Substantial Completion.

**END OF SECTION**

**SECTION 33 0000  
SITE UTILITIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Excavation, Trenching, & Backfilling for Water & Wastewater Utilities.
  - 2. Water and Wastewater Line Separation Requirements.
  - 3. Water Mains and Appurtenances.
  - 4. Wastewater Mains and Appurtenances.
  - 5. Final Site Utility Inspection Requirements.

**1.2 SUBMITTALS**

- A. Product Data: Pipe materials, pipe accessories, pipe fittings, valves, and accessories.
- B. Manufacturer's Certificate: Products meet or exceed specified requirements.
- C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

**1.3 CLOSEOUT SUBMITTALS**

- A. Project Record Documents: Record locations of pipe runs, connections, and manholes, cleanouts, and invert elevations.

**1.4 QUALITY ASSURANCE**

- A. Perform Work according to Navajo Tribal Utility Authority Construction Requirements and Technical Specifications for Materials and Workmanship for Water and Wastewater Facilities.

**1.5 EXISTING CONDITIONS**

- A. Field Measurements:
  - 1. Verify field measurements prior to fabrication.
  - 2. Indicate field measurements on Shop Drawings.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Furnish materials according to Navajo Tribal Utility Authority Construction Requirements and Technical Specifications for Materials and Workmanship for Water and Wastewater Facilities.

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Protect and support existing utility lines and appurtenances as Work progresses.

**3.2 INSTALLATION**

- A. Installation Standards: Install Work according to Navajo Tribal Utility Authority Construction Requirements and Technical Specifications for Materials and Workmanship for Water and Wastewater Facilities.

# **NAVAJO TRIBAL UTILITY AUTHORITY CONSTRUCTION REQUIREMENTS**

**Reviewed by:  
NAVAJO NATION and HIS STANDARDS COMMITTEE**



## **TECHNICAL SPECIFICATIONS FOR MATERIALS AND WORKMANSHIP FOR WATER AND WASTEWATER FACILITIES**

**REVISED SEPTEMBER 2008**

**TECHNICAL SPECIFICATIONS FOR MATERIAL AND WORKMANSHIP OF WATER  
AND WASTEWATER FACILITIES**

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**DRAWING STANDARDS AND LEGEND**

**DEFINITION OF TERMS:**

- Owner:** The organization or its representative authorizing and administering the construction project.
- Contractor:** The organization or its representative performing the construction.
- Operating Utility:** The organization or its representative operating the water and wastewater utility affected by the construction.
- Roadway Authority:** The authority or agency with jurisdiction over the roadway.
- Or Approved Equal (OAE):** A substitute in material that is considered by the **Operating Utility** to be equal to or better than the item listed in the specifications or standards.
- NTUA:** The utility owner, **Navajo Tribal Utility Authority**

## **TECHNICAL PROVISIONS 1.0**

### **TP 1.0 EXCAVATION, TRENCHING, AND BACKFILLING FOR WATER AND WASTEWATER UTILITIES**

#### **1.01 Scope of Work**

The work covered by this section includes the furnishing of all plant, labor, tools, equipment, and material, and performing all operations in connection with excavating, trenching, and backfilling, for installations of all water/wastewater utility pipelines, related structures, and accessories. This includes the necessary clearing and grubbing, pavement cutting, compaction, pavement restoration, grading, and cleanup, all in accordance with these Technical Provisions and applicable drawings. The final installation also shall meet the requirements of Section 2.0, Water, and Wastewater Line Separation Requirements.

If there is a conflict between these Technical Provisions and any other section of the specifications and/or drawings, then the most stringent, as determined by the Owner and/or NTUA shall apply.

#### **1.02 Layout and Staking**

All layout and staking for site work shall be performed by a licensed engineer or land surveyor, approved by the Owner and/or NTUA, who is to be paid by the Contractor, unless other arrangements are negotiated. Copies of survey notes shall be submitted to the Owner and the NTUA, with one or more copies remaining on the job site at all times.

#### **1.03 Protection of Excavations**

The Contractor shall provide suitable sheathing, shoring, and bracing to protect all excavations as required, to provide safe working conditions as directed by the NTUA. and in conformance with applicable OSHA and all other safety regulations. The Contractor at his expense shall repair damages resulting from settlements, slides, cave-ins, flooding, pipeline breaks, and other causes. Suitable signs shall be so placed as to show in advance where construction, barricades, or detours exists.

The Contractor shall at all times perform his work to insure the least possible obstruction to traffic, inconveniences to the general public and residents in the vicinity of the work, and to insure the protection of persons and property in a manner satisfactory to the Owner and the NTUA.. No road or street shall be closed to the public except with the permission of the proper authority. Fire hydrants on or adjacent to the work site shall be kept accessible to fire-fighting

equipment at all times. Temporary provisions shall be made by the Contractor to insure the use of sidewalks, and the proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches.

#### **1.04 Protection of Existing Utilities**

It shall be the Contractor's responsibility to determine the locations of all known existing underground utilities not shown on the drawings and to confirm the exact locations of those existing utilities shown on the drawings. All existing utilities shall be protected from damage, during excavation and backfilling of trenches and if damaged, shall be repaired at the expense of the Contractor.

#### **1.05 Excavation**

##### **1.05.01 General**

It is expected that all excavation required for the performance of the work shall be made by open cut methods unless otherwise specified and shown on the drawings or as required by applicable permits.

##### **1.05.02 Grading and Stacking**

All grading in the vicinity of the construction shall be controlled to prevent surface water from flowing into the excavation. Any water accumulated in the excavation shall be removed by pumping or other approved method. During excavation, material suitable for embedment and backfilling shall be piled in an orderly manner, a sufficient distance back from the edges of the bank to avoid overloading and to prevent slides or cave-ins. Material unsuitable for backfilling shall be hauled from the job site and disposed of by the Contractor at approved disposal sites.

##### **1.05.03 Pavement Cutting**

Where it is necessary to remove sections of asphalt pavement, the asphalt shall be clean-cut with approved equipment in a neat line 6 inches back from the outside edge of the excavation, in order to provide a key when restored.

Where it is necessary to remove sections of concrete pavement, the concrete shall be saw-cut to a depth of not less than 1-1/2-inches with neat vertical lines in such a manner that the adjoining surfaces will not be damaged.

##### **1.05.04 Rock Excavation**

If given special consideration, rock is considered to exist when excavation cannot be accomplished using a 790E John Deere Class track hoe with a rock bucket, without stressing the machine. The NTUA shall be the sole party in determining the existence of rock and the appropriate means of removal. The quantity of rock shall be determined in cubic yards of material removed. All other trenching and excavations, regardless of materials encountered, equipments used, or methods required for excavation, will be unclassified.

#### **1.05.05 Dewatering**

The Contractor shall remove and dispose of all water entering the trenches and shall keep the trenches water free until the water or wastewater lines and other appurtenances are in place. In no case shall water, earth, or any foreign materials be allowed to enter the water or wastewater pipelines.

#### **1.05.06 Excavation for Structures**

Excavation for appurtenances such as manholes, valves, foundations, catch basins, culverts, subterranean formwork, and other structures shall be to the necessary depth and sufficient width to leave at least 12-inches of space between the structure's outer surface and the embankment or shoring used to stabilize the banks.

#### **1.05.07 Over-Excavation**

Whenever solid or loose rock, rocky soil with rocks larger than 3/4-inches in their largest dimension, or otherwise unsuitable soils which are incapable of properly supporting the pipe or structure are encountered in the trench bottom, all unsuitable material, as determined by the Owner and NTUA, shall be over-excavated to a minimum depth of 6-inches below the pipe or structure and removed.

Except at locations where over-excavation is required, care shall be exercised not to excavate below the depths indicated. In the event of accidental over-excavation, the trench bottom grade will be restored in the same manner as areas specified to be over-excavated.

#### **1.05.08 Trench Excavation**

The sides of all trenches for the installation of utility piping system shall be as nearly vertical as soil conditions will allow from ground level to the pipe. Except for the trenching of 1-inch water service lines, the width of the trench shall be a minimum of 16-inches and a maximum of 30-inches wider than the outside diameter of the pipe. Trench

excavation shall be centered on pipe alignment such that a minimum clearance of 8-inches is provided on each side of the pipe. Trench width above the level of the top of the pipe may be as wide as necessary for shoring or sheathing and for proper installation of the work.

The depth of all trenches shall be as indicated on the drawings. If not otherwise specified, the depth of all trenches shall be in accordance with the specifications for the installation of waterlines and wastewater lines.

Unless otherwise required by applicable permits, the maximum length of trench that may be left open at any one time shall not exceed 500 feet.

## **1.06 Placement and Compaction of Pipe Embedment and Backfill Material**

### **1.06.01 Pipe Embedment**

Pipe embedment: Pipe embedment is defined as that material required to bring the trench bottom up to surface grade and that material placed alongside and above the pipe to a level of at least 6-inches over the top of the pipe. Pipe embedment shall be selected earth or sand, which contain no stones, dry or frozen lumps greater than 3/4-inch in diameter, or other unsuitable material as defined by the NTUA. Embedment and the first 6-inches of backfill, above the top of the pipe in rock excavation shall be done in the presence of the NTUA. Any backfilling, done in violation of this provision shall be cause for removal and replacement of the embedment, at the expense of the Contractor even though the work is found to be in accordance with these specifications.

Bedding: Bedding is that portion of pipe embedment zone beneath the pipe. If the native soil is suitable for bedding, the bottom of the trench shall be accurately shaped to provide uniform bearing and support for the entire length of the pipe. Bell holes shall be excavated to provide minimum clearances of 2-inches below the couplings or bells. Imported bedding material shall likewise be placed to provide uniform and adequate longitudinal support under the pipe. Bedding material shall be placed and compacted in lifts not to exceed 6-inches in loose measure.

Haunching: Haunching is that portion of the pipe embedment zone from the bottom of the pipe to the spring line of the pipe. Haunching material shall be placed and hand tamped to provide adequate side support to the pipe while avoiding both vertical and lateral displacement of the pipe from proper alignment.

Initial Backfill: Initial backfill is that portion of the pipe embedment zone from the spring line of the pipe to a minimum of 6-inches above the top of the pipe. Initial backfill material shall be placed and

compacted in lifts not to exceed 6-inches in loose measure. Compaction shall be performed in such a manner so as to avoid damage and disturbance of the embedded pipe.

Final Backfill: Final backfill is defined as that material used in the area between the initial backfill and the existing ground surface. Material shall be placed and compacted in lifts not to exceed 6-inches in loose measure except as otherwise specified.

**1.06.02 Compaction Requirements**

Unless otherwise specified by permit issued by the roadway authority or by special arrangement between the NTUA, bedding, haunching, initial backfill, final backfill, and gravel resurfacing shall be compacted to the following percentages of the maximum density as determined by ASTM D1557. (If using Standard Proctor ASTM D-698, add 5% to all compaction requirements listed in the table below). In-place densities of materials shall be determined by the sand-cone method, ASTM D1556 or by the nuclear method, ASTM D2922.

Percent of Maximum Density - D1557

Backfill Location	Bedding Backfill	Haunching Backfill	Initial Backfill	Final Backfill
Roadway Rights-of-Way Within Roadway Prism	95% *	95%	95%	95%
Roadway Rights-of-Way Outside of Roadway Prism	90% *	90%	90%	95%
All Other Conditions	90%	90%	90%	90%

\* or the existing condition within the undisturbed bottom of the trench.

**1.06.03 Water Jetting**

The introduction of water to the pipe embedment or final backfill material shall not be permitted as a means of compaction.

**1.07 Imported Backfill**

**1.07.01 Imported Pipe Embedment**

If the native soil is unsuitable, the Contractor shall import suitable pipe embedment material. Pipe embedment shall be select earth or sand which contains no stones, dry lumps, or frozen lumps greater than 3/4-inches in diameter and shall be defined as 100% passing 3/4-inches, 40-99% passing # 4 sieve and 30% or less passing # 200 sieve.

Unsuitable material is defined as solid or loose rock, soils with rocks larger than 3/4-inches in their largest dimension, or other unsuitable soils which are, as determined by the NTUA, incapable of properly supporting the pipe.

#### **1.07.02 Imported Final Backfill**

If the native soil is unsuitable for use as final backfill, the Contractor shall import suitable final backfill. Imported final backfill may be any material, which is locally available and is capable of being compacted to the required density. This material shall be free of boulders and rocks larger than 6-inches in their smallest dimension, frozen clumps of dirt, organic material, or rubble, which could damage the pipe.

### **1.08 Bedding and Backfill for Structures**

#### **1.08.01 Bedding**

Bedding material for structures is defined as that material beneath the structure. This material shall be as specified in the standard detail for each structure.

#### **1.08.02 Backfill**

Backfill for structures is defined as that material from the bottom of the structure to the existing ground surface. This material and the required compaction of such shall be the same as that specified for in the final backfill on pipelines, or as specified in the drawings.

### **1.09 Settlement of Adjacent Structures**

Throughout the 1-year warranty period, the Contractor shall be required to fill and compact any areas where settlement has taken place and shall also be responsible for the settlement of any adjacent structure or object caused by any excavation performed under his contract.

### **1.10 Surface Restoration and Resurfacing**

#### **1.10.01 Surface Restoration**

The following requirements shall be followed unless alternative specifications are set forth by the roadway or other rights-of-way crossing permits, or as arranged between the NTUA and the NMDOT.

After the piping and structures have been installed and all backfilling completed, areas, which were disturbed, shall be brought to true grades.



All slopes shall be trimmed and dressed, and all surface graded to maintain existing drainages. All streets, alleys, driveways, sidewalks, curbs, or other surfaces, which have been disturbed or damaged, shall be resurfaced or replaced. The Contractor shall properly dispose of all excess excavated materials.

As required by the operating utility, the contractor shall install the utility brand Carsonite markers at all road crossings, water valves, fittings, junctions, connections, points of intersection, or at a minimum, every 1500 feet. Naturally, this would apply only within the rural areas, along stretches of roadways, or as requested by the operating utility. This is also a requirement for marking sewer manholes, cleanouts, and service connections.

#### **1.10.02 Roadway Patching**

Whenever existing roadways are disturbed during the course of construction, the Contractor shall restore the roadways to their original condition.

For ease of compaction, the Contractor may use well-graded gravel, crushed stone, or flowable fill as backfill, from a Ready Mix plant as approved by the appropriate roadway agency. The material shall be clean, varying in size from 3/8-inches to 1-1/4-inches, with not more than 10 percent of the material less than 3/8-inches in size and shall be compacted in 6-inch layers or as directed by the NMDOT. Flowable fill is defined as one bag concrete, with gradations of 100% passing the 3/8 sieve, and less than 25% passing the #200 sieve. The slump should be between 5-inches and 8-inches, and the 28-day strength should be between 50 and 150-PSI.

Surfacing shall be replaced where the roadway has gravel, crushed stone, asphaltic, or concrete surfacing. Gravel or crushed stone shall be replaced in quantities and locations as directed by or as required by the roadway permitting authority. Asphalt mix or concrete surfacing shall be replaced, in the case of asphalt, appropriately compacted in roadways to a depth equal to existing roadway surface but not less than 2-inches in asphalt or 6-inches in concrete. A compacted stabilized gravel or crushed stone base 6-inches in depth shall be placed in the roadway at all locations where surfacing is required prior to placement of the bituminous or concrete wear course, unless other requirements are stipulated by the roadway authority.

The Contractor shall obtain any and all necessary written permissions, easements, and permits from federal, state, and county agencies prior to beginning any roadway excavation.

## **TECHNICAL PROVISIONS 2.0**

### **TP 2.0 WATER AND WASTEWATER LINE SEPARATION REQUIREMENTS**

#### **2.01 General**

Water lines located near wastewater facilities present conditions for serious potential cross contamination. Protection from cross contamination can be provided by separation of the facilities and use of special piping materials. For measuring separation between pipes, all measurements shall be the clearances between pipes. (Pipe O.D. to pipe O.D.).

#### **2.02 Horizontal Separation of Water and Wastewater Lines**

When water and wastewater lines are laid parallel to each other, the horizontal distance between the water and wastewater lines shall not be less than 10 feet. Each line shall be laid in separate trenches. The requirements for this separation shall apply to all other buried utilities, except the distance may be reduced to 5 feet for secondary electric and gas distribution lines less than 60-PSIG; however, all stipulations of the electric, gas, or other sub-surface utilities shall be met.

When physical conditions such as an existing obstruction, will not allow the required 10-foot horizontal separation, the water and wastewater mains may be laid closer than 10 feet if the bottom of the water main is a minimum of 12 inches above the top of the wastewater main and prior written approval is granted by the NTUA.

#### **2.03 Vertical Separation of Water and Wastewater Lines**

##### **2.03.01 Water Above Wastewater**

When waterlines cross wastewater lines, the waterline shall cross above the wastewater line with a minimum vertical separation of 12 inches. If necessary, the depth of bury for the waterline may be reduced to 36 inches (normally 42 inches) at the crossing to maintain the 12-inch vertical separation. No joints in new waterlines shall be permitted within 10 feet of crossing a wastewater line.

##### **2.03.02 Wastewater Above Water**

When a waterline must cross below a wastewater line, the minimum vertical separation between the lines is 12 inches. Backfill of the trenches shall be compacted to provide adequate support to prevent settling of the wastewater line and damaging the water line.

For new water construction, the waterline shall be normal PVC water pipes with 20-foot pipe sections centered on the wastewater crossing. No joints of new waterline construction shall be permitted within 10 feet of crossing a wastewater line. While it is desirable to have all crossings perpendicular or normal, new waterlines (centered on the crossing) may cross under a wastewater line at a maximum of 25° from perpendicular.

For new wastewater construction, the wastewater line shall be ductile iron pipe with gasketed joints, or approved equal (OAE), with an 18-foot section centered on the crossing. No joints in new wastewater line construction shall be permitted within 9 feet of crossing a water line.

**For water and wastewater lines crossing electric, gas, or other buried facilities; the standards established by that other specific utility must be met.**

**2.04 Water Main Separation from Wastewater Manholes**

No waterline pipe shall pass through, under, or come into contact with any part of a wastewater manhole.

**2.05 Water and Wastewater Service Line Separation Within 5 feet of the House**

This section shall apply to that portion of water and wastewater service lines located within 5 feet of the house. All lines within 5 feet of the house will be considered as part of the house plumbing. For new construction, all service lines shall have a 10-foot minimum horizontal separation. This can be accomplished by having the water and wastewater service lines exit the house 10 feet apart or from different sides. If the 10-foot separation cannot be maintained and prior written approval is obtained from the NTUA, the service lines can be laid closer than 10 feet, if the bottom of the water service line is at least 12-inches above the top of the wastewater service line; and the water service line is continuous with no joints until the separation requirement is met.

**2.06 Separations Between Waterlines and Components of the Wastewater Disposal System**

Waterlines shall not be installed within 10 feet of a septic tank, within 25 feet of a drain field, or 50 feet from an outhouse. Also, waterlines shall not be installed within 100 feet of the perimeter fence of an **individual** lagoon, or within 500 feet of the perimeter fence of a **community** lagoon.

**2.07 Separation Between Residences and Wastewater Lagoons**

No permanent residence shall be within 1000 feet from the perimeter fence line of

a **community** sewer lagoon, or within 300 feet from the perimeter fence line of an **individual** sewer lagoon without written consideration of the Operating Utility.

### **TECHNICAL PROVISIONS 3.0**

## **TP 3.0 WATER MAINS, WATER SERVICE LINES, AND APPURTENANCES**

### **3.01 Scope of Work**

The work covered by this section includes the furnishing of all labor, equipment and tools, and material; performing all operations in connection with the construction of water mains, including the placing of all necessary valves, hydrants, fittings, and appurtenances, and the construction of water service lines and appurtenances, in accordance with these technical provisions and applicable drawings.

### **3.02 Water Mains**

#### **3.02.01 Polyvinyl Chloride (PVC) Pipe and Fittings**

Fittings for PVC pipe 4-inch and larger shall be Class 350 SSB mechanical joint, ductile iron conforming to AWWA C153 and shall be cement mortar-lined conforming to AWWA C104 or if shown on the plans, may be Class 200 PVC Bell and Gasket, conforming to ASTM D3139 and D1784, Type 1, Grade 1, and ASTM D2241.

PVC pipe shall conform to ASTM D2241 and the pipe shall be PVC 1120, SDR 21 and 200-PSI pressure rating or SDR 26 and 160-PSI, as specified on the plans. All PVC pipe joints shall be rubber compression ring type gaskets conforming to ASTM D3139 - Rieber type or equal. Special piping provisions are required when higher pressures are encountered.

Plastic pipe with scratches, gouges, or grooves deeper than one-tenth (0.10) of the wall thickness shall be rejected. Damaged sections of pipe shall be completely destroyed or immediately removed from the job site.

Ductile Iron pipe of specific class and type as shown on the plans may be required under certain circumstances. The pipe may require polyethylene encasement. In cases where the soil environment is corrosive -the soil resistivity is less than 1000 ohm-cm, the PH is less than 4 or greater than 8.5, or sulfides or high moisture content exist in the soil, etc. -the Contractor shall be required to wrap all mechanical joint fittings and all Ductile Iron pipe with 9 mill polyethylene film per AWWA C105/A21.5.

### **3.02.02 Water Main Installation**

Pipe and fittings shall be installed generally in accordance with the manufacturer's printed instructions and specifications, to the standards of the AWWA for installing the type of pipe used, and in accordance with the NTUA Technical Provisions. Minimum bury depth shall be 42-inches, unless otherwise specified, with a maximum depth of 72-inches, unless specifically exempted by the NTUA Engineer.

Pipe and fittings shall be carefully handled to avoid damage. Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material shall be removed, cleaned, and re-laid. When pipe installation is not in progress, the open ends of the pipe shall be closed with a watertight plug.

Long radius curves, either horizontal or vertical, may be installed with standard pipe by deflecting at the joints. The amount of deflection at each pipe joint shall not exceed the manufacturer's printed recommended deflections. When rubber gasket pipe is laid on a curve, the pipe shall be jointed in a straight alignment and then deflected to the curved alignment. Trenches shall be excavated wider on curves for this purpose.

### **3.02.03 Connections to Existing Mains**

A permission to tap permit shall be obtained from the local NTUA office by the Contractor and all work shall be in conformance with said tapping permit.

Connections to existing mains shall be dry connections, made in a neat and workmanlike manner, unless otherwise permitted by the NTUA. Each connection to an existing waterline shall be made at a time and under conditions which will least interfere with water services to customers affected thereby, or as authorized by the NTUA and as evidenced by an approved tapping permit. Such connections shall be made to the satisfaction of the NTUA. Proper tools and fittings to suit actual conditions encountered in the field in each case shall be utilized. The cutting of pipe for inserting fittings or closure pieces shall be done in strict accordance with the recommendations of the pipe manufacturer, without damage to the pipe, or coating, and so as to leave a smooth end at right angle to the axis of the pipe.

Great care shall be taken to prevent pipeline contamination when

cutting into and making connections with existing pipelines used for the conveyance or distribution of water for domestic or public use. The Contractor shall coordinate and cooperate with the NTUA, in locating services and shall conduct his operations in such a manner that trench water, mud, or other contaminations are not allowed to enter the connected line or lines, at any time during the progress of the work. The interior of all pipe, fittings, and valves installed in such connections shall be thoroughly cleaned and then swabbed with or dipped in strong chlorine solution having a chlorine content of 200 parts per million (PPM).

### **3.03 Valves For Water Mains**

#### **3.03.01 Gate Valves**

All gate valves shall conform to AWWA Specification C509, iron body, epoxy coated, bronze mounted, resilient wedge, counter clockwise opening, inside screw, non-rising stem with O-ring seals, and a 2-inch square wrench nut. Valve working pressure rating shall be 200-PSI minimum. The valves shall be Mueller, Kennedy, Waterous, Dresser M & H, Clow, or an approved equal (OAE) with mechanical joints as specified on the plans with appropriate transition gaskets. For operating pressures greater than 200-PSI, special considerations shall be followed.

#### **3.03.02 Valve Boxes**

Valve boxes shall be installed on all buried valves and shall be 5-1/4-inch nominal diameter shaft, two-piece adjustable screw type equal to Tyler No. 6850 Series. The length of the box shall be sufficient to permit access to the valve at the specified depth of bury. Tyler Series extensions will be utilized to extend the valve box where required. The word "Water" shall be cast onto the lid.

#### **3.03.03 Valve Installation**

Before installing the valve, care shall be taken to see that all foreign material and objects are removed from the interior of the valve. The valve shall be opened and closed to see that all moving parts are in working order, prior to installation.

All valves shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connecting ends furnished. All valves shall be set in and tied to poured in-place concrete support blocks as per the NTUA standard detail. Valves and valve boxes shall be set plumb. The cast iron valve boxes shall be placed over valves in such a

manner that the valve boxes do not transmit shock or stress to the valve. The valve box cover shall be set flush with, or slightly above the finished grade, as shown per the NTUA standard detail. A 2-foot square by 4-inch deep reinforced concrete pad shall be poured around each valve box. Before the concrete hardens, the Contractor shall neatly scribe in the concrete pad, the valve and pipe size and type, and a line indicating the direction of flow of water through the valve.

### **3.04 Fire Hydrant Assembly**

#### **3.04.01 Fire Hydrant**

Fire hydrants shall be of standard manufacture with the name of the manufacturer and direction of opening cast on the hydrant top. Fire hydrants shall conform to AWWA C502. The end connections shall be mechanical joint. The hydrants shall be equipped with a breakaway safety flange and safety stem coupling at or near the bury line such that a heavy impact would minimize breakage of hydrant parts. The hydrants shall open counter clockwise, have a 5 1/4-inch or larger main valve opening, 6-inch inlet, 1 1/2-inch tapered pentagonal operating nut, 2 hose nozzles 2 1/2-inches in diameter, and a 4 1/2-inch pumper nozzle, all with National Standard hose threads. The hydrant shall be Mueller A423, Kennedy K81A, or an approved equal OAE.

#### **3.04.02 Hydrant Connections and Auxiliary Gate Valves**

An auxiliary gate valve and valve box shall be installed adjacent to each fire hydrant per the standard detail or as specified on the plans. The pipe between the fire hydrant and the auxiliary gate valve and between the auxiliary gate valve and the main shall be 6-inch minimum.

#### **3.04.03 Fire Hydrant and Guard Installation**

Before installing any hydrant, care shall be taken to see that all foreign materials and objects are removed from the interior of the barrel. The hydrant shall be opened and closed to see that all moving parts are in working order.

Hydrants shall be installed plumb with the pumper nozzle toward the street. The hydrant shall be set per the standard detail for the hydrant and guard.

### **3.05 Thrust Blocking**

Thrust blocking as detailed in the standard drawings shall be placed at all bends, caps, tees, crosses, and fire hydrants. Blocking shall be concrete mix poured in

place. Concrete blocking shall bear against solid undisturbed earth at the sides and bottom of the trench excavation and shall be shaped so as not to block weep holes or obstruct access to the joints of the pipes or fittings. The concrete shall not cover nuts and bolts of joints or fittings. Ductile Iron Joint Restraints used in conjunction with Mechanical Joint fittings may be used as a substitute for concrete blocking.

### **3.06 Water Main Crossings**

#### **3.06.01 Wash Crossings**

Water mains shall be installed as shown on the plans. The Contractor shall divert surface flows, conduct dewatering, and perform all steps necessary to maintain proper bedding conditions and alignment. A minimum 6-foot depth of bury is required at the centerline of all wash crossings.

#### **3.06.02 Road Crossings**

In lieu of boring, roads may be open cut for water line and casing installation. The original surface pavement on all open cut roadways shall be either cut square or sawed straight. As with open cut, if boring is required the steel conduit shall be extended from right-of-way to right-of-way. The Contractor shall obtain written permission from the appropriate agency prior to beginning any roadway excavation. Backfill within the limits of a roadway prism may require special compaction in accordance with the requirements of the roadway crossing permits.

Surfacing shall be replaced where the roadway has gravel, concrete, or asphaltic paving in the same thickness as were removed, or as specified by the roadway agency, and completed as soon as possible following backfilling.

Ductile iron pipes resting on the bells within the steel casing shall be used as the carrier pipes. PVC waterline road crossings may also be installed within the steel casing on approved casing chocks or redwood skids secured to the pipe with stainless steel straps. The casing ends shall be sealed with an approved rubber boot or 9-mil plastic sheeting with stainless steel clamps. Casing pipe shall be straight welded Schedule 10 steel pipe, .25-inch wall thickness, unless otherwise specified. An alternate method for roadway crossing is to install ductile iron pipe, Class 52, bell and spigot, direct bury by open cut excavation from right of way to right of way. This would be considered when crossing minor roads or trails, or for congested area within an urban setting.



For pressure testing purposes, gate valves will be required on the upstream and downstream side of roadway crossings.

### **3.07 Water Service Connections Material**

#### **3.07.01 Polyethylene (PE) Pipe**

Polyethylene (PE) pipe shall be 1-inch IPS, 200 psi, SIDR 7 in conformance with ASTM D2239. The pipe shall be produced from a high density ultra-high molecular weight PE pipe compound, PE 3406 or PE 3408 which conforms to the latest revision of ASTM D1248. The pipe shall be equal to Driscopipe 5100 Ultral-line or Yardley Ultra-high Molecular Weight PE. The designation PE 3406 or PE 3408 shall be stamped on the pipe.

#### **3.07.02 Service Line Fittings and Connections**

Fittings and connections for PE pipe shall be made with non-flare compression connections and shall be Mueller Insta-Tite H-15426, or approved equal. All threaded connections from the water main to and including the inlet of the domestic stop shall be standard iron pipe (I.P.) threads.

#### **3.07.03 Saddles**

Saddles shall be specific for the type, size, and pressure rating of the mainline as recommended by the saddle manufacturer. Saddles shall be double strapped, double banded, or of the contoured band type. Saddles and saddle components shall be brass, bronze, or stainless steel. Tap threads shall be FIP. Acceptable saddles include Ford S71 and Mueller H-13478 for IPS PVC O.D. pipe, or Ford 202B or approved equal for DI and AC O.D. pipe.

#### **3.07.04 Corporation Stops**

Corporation stops shall be bronze alloy with MIP threads inlet by FIP threads outlet. They shall be equal to Mueller H-10046 corporation stops or Ford Type FB1700.

#### **3.07.05 Curb Stops**

Curb stops shall be 1-inch bronze alloy, quarter turn check, FIPT x FIPT end connections, with tee head and 30-inch (approx.) stationary operating rod. Curb stops shall be Minneapolis pattern top threads with resilient O-rings seals and equal to the Mueller B-20287, or Ford B11-444M or AY McDonald 6105.

### **3.07.06 Curb Stop Boxes**

Curb stop boxes shall be the extension type, cast iron with 1 1/2-inch upper section. Curb box lid shall be cast iron and have a countersunk brass pentagon head plug. The curb stop boxes shall be Minneapolis pattern 2-inch base bushed to 1 1/2-inch and equal to Mueller H-10302 or Ford Type PXL. The finished elevation of the plug shall be such that it extends just slightly above the ground surface. The stationary rod shall be sized so that the top extends 2 to 4 inches below the top of the curb box. An 18-inch by 18-inch by 4-inch depth reinforced concrete collar shall be poured around each curb box.

### **3.07.07 Water Meters**

Water meters shall be of cast bronze construction with magnetic drive and a hermetically sealed register which reads in gallons. The meter shall accurately record flows from 1/4 to 20 gpm and shall be a 5/8-inch by 3/4-inch Sensus SR model with frost plate. The Sensus SR II model is not acceptable.

### **3.07.08 Meter Yokes/Coppersettters**

Yokes or coppersettters for water meters shall have 3/4-inch ID x 12-inch riser, with a ball valve with padlock wing angle on the inlet, with a meter nut on the outlet side, and in the base, a 1-inch double purpose union swivel inlet and outlet connection. Yokes shall have an eye for the insertion of a cross brace and equal to Ford VB 72-12W-11-44 or AY McDonald 20-212WX-DD-44. The cross brace shall be a 1/2-inch OD PVC pipe or # 4 rebar 18-inches in length. The tandem coppersetter shall have an "S" tube with two bronze adapters, iron thread by meter nut, for the pressure regulators. The PRV shall be Watts Series 25AUB or approved equal.

### **3.07.09 Meter Boxes**

Meter boxes shall be 20-inches diameter, 30-inches high nonmetallic by DFW or approved equal and shall be extended a minimum of 1-inch below the service line. The meter box lid shall be a cast iron, double lid cover with 11-1/2-inches lid opening, plastic or aluminum inner lid, and locking outer lid with pentagon head worm type lock. The meter box cover shall be equal to Castings model M 70.

### **3.07.10 Domestic Stops (Not part of the NTUA's facilities)**

Domestic stops shall be a 1-inch bronze alloy, quarter turn check, FIPT x FIPT end connections, with tee head and 39-inch stationary operating

rod. They shall have resilient O-rings seals and equal to the Ford B11-444 or AY McDonald 610.

### **3.07.11 Domestic Stop Valve Boxes (Not part of the NTUA's facilities)**

The domestic stop valve box shall consist of 3-inch diameter PVC-DWV pipe with a 3-inch hub by FIP threaded adapter with a 3-inch MIP threaded plug for the lid. The finished elevation of the plug shall be such that the stationary rod is located immediately below or within the plug so that the rod can be operated with an adjustable wrench from ground surface with the plug removed. The 3-inch diameter PVC-DWV pipe shall be cut so that the top of the adapter extends 3 to 6-inches above ground surface.

### **3.08 Water Service Line Installation**

Water service lines and appurtenances shall be installed in accordance with TP 1.0, Excavation, Trenching, and Backfilling for Water and Sewer Utilities, and TP 2.0, Water and Sewer Line Separation Requirements. A minimum of 3 feet of cover is required for water service lines.

Service lines shall be cut using tools specifically designed to leave a smooth, even, and square end on the pipe. The cut ends shall be reamed to the full inside diameter of the pipe. Pipe ends are to be connected using fittings which seal to the outside surface of the pipe which shall be cleaned to a sound smooth finish before installation. Splices shall be kept to a minimum and no splices shall be made within 10 feet of any sewer line.

All 1-inch service connections to water mains 4-inches or larger shall be made using saddles (tap tees are permitted for new construction). Service connections to 2-inch pipe shall be made using tees. Particular care shall be exercised to assure that the main is not damaged by the installation of the saddle. The saddle shall be aligned on the water main so that it is at a 45 degree angle above the springline of the pipe. The hole drilled into the pipe through the saddle shall be no smaller than 1/8-inch less than the size of the saddle.

Where required, the Contractor shall reconnect existing water service connections to the new water mains using materials specified herein. Individual pressure reducing valves, where required, shall be installed on a tandem meter yoke as shown on the standard detail. Prior to installation of the meter and connection to the building or house, the entire water service line and appurtenances shall be flushed.

### **3.09 Pressure Tests**

Where any section of a waterline is provided with concrete thrust blocking for fittings or hydrants, the pressure tests shall not be conducted until at least 48 hours after installation of the concrete thrust blocking, unless otherwise specified.

### **3.09.01 Pressure Test**

All labor, test equipment, water for testing; appurtenances and material, and performance of all operations in accordance with the specifications, are the responsibility of the Contractor.

All pipelines shall be tested for water tightness up to the individual service meter or domestic stop. The test equipment will not be provided, but is subject to inspection by the NTUA. Arrangements for water used in pipeline testing and payment for the water shall be coordinated with the local NTUA office. Pressure gauges used for pressure testing, shall be graduated at a maximum of 5-PSI increments. Two gauges will be used simultaneously for verification of the gauges functionality. Prior to the actual test, the pipeline shall be pressured to 10-PSI above the test pressure. The pressure will then be decreased to the test pressure, after the required time, so that gauge responsiveness can be observed.

The minimum test pressure shall be at least 160-PSI, measured at the lowest point of elevation in the test section. No section shall be tested that is greater than one mile in length or that has greater than 25-PSI pressure change, due to elevation. The test shall be conducted in such a manner that existing mains, services lines, and service user's plumbing are not damaged. Damage caused by testing shall be corrected at the expense of the Contractor. All connections, valves, blow-offs, hydrants, and house services up to the meter yoke shall be tested with the main, as far as are practicable. When testing piping systems designed to operate above 160-PSI, it will be tested as if it were rated at 160-PSI.

#### **No air testing shall be allowed.**

The test section shall be filled slowly with potable water and all air shall be vented from the line. The test shall not begin until the pipe has been filled with water for at least 24 hours to allow for absorption. The test shall have a minimum duration of two hours with the two-hour period beginning when the test pressure is attained and the pump ceases operation.

No pipe installed shall be accepted if the leakage is greater than that determined by the following formula:

$$Q = \frac{N * D * (P)^{1/2}}{7400}$$

in which,

Q = Allowable leakage in gallons per hour

N = Number of joints in the pipeline being tested, this "N" being the standard length of pipe furnished divided into the length being tested with no allowance for double gasket joint caused by use of couplings instead of integral bell pipe or for joints at branches, blow-offs, fittings, etc.

D = Nominal diameter of pipe in inches

P = The test pressure in PSI gauge as discussed in the third paragraph of this procedure.

During the test, the test pressure should not lose more than 5-PSIG without being pumped back up to the test pressure. The total of the gallons of water required to hold the test pressure during the two hours plus the amount of water required to return the line to the test pressure at the end of the two-hour test period is the total leakage. If the total leakage is less than the allowable leakage, the line can be accepted. All visible leaks will be repaired, regardless of the amount of leakage. Should the test on any section of the pipeline show leakage greater than the allowable leakage, the Contractor shall locate and repair the defective pipe, fitting, or joint until the leakage is within the allowable leakage for the two-hour test duration.

### **3.09.02 Observation of Tests**

The NTUA shall witness the pressure testing of waterlines. Prior to the actual test, the Contractor shall have all equipment set up completely, ready for operation and shall have previously successfully performed the test to verify that the test section will pass. The Contractor shall notify both the NTUA and the NMDOT a minimum of three working days in advance of the date that the Contractor plans to perform the pressure tests.

The NTUA shall observe the testing to verify that the testing was performed according to the specifications and that the test data were properly and accurately recorded. The Contractor shall complete the required certification forms and submit them to the NTUA for approval. A letter of approval or disapproval of the test results will be sent from the Operating Utility to the Contractor.

### **3.10 Disinfection**

A liquid chlorine solution shall be introduced continuously into one end of the system and allowed to flow along and through all lines and appurtenances to be disinfected until a minimum of 50-PPM of chlorine is detected at representative points throughout the line. A contact period of 24 hours shall be maintained before the system is flushed out with clean water until a maximum of 0.4-PPM chlorine residual is attained. All valves shall be operated several times during the 24-hour contact period.

After disinfection, the Contractor shall collect bacteriological samples for testing at his expense. A laboratory certified by the State Health Department or the U.S. Environmental Protection Agency shall perform the analysis. If an unsatisfactory bacteriological test result (positive result) is obtained, the system shall be disinfected and re-tested by the Contractor. This shall be repeated until a satisfactory bacteriological test (negative result) is obtained. Disinfection by introducing granular or tablet chlorine compounds in each pipe length is not an acceptable method of disinfection and will not be allowed.

**EXHIBIT A OF TP-3  
WATER LINE PRESSURE TEST CERTIFICATION**

LOCATION OF LINE TESTED: \_\_\_\_\_  
Include Project Name & Number

DATE(S) TEST WAS CONDUCTED: \_\_\_\_\_

GAUGES MANUFACTURER AND MODEL: 1) \_\_\_\_\_

2) \_\_\_\_\_

STANDARD LENGTH OF PIPE IN TEST SECTION: \_\_\_\_\_ FEET.

TEST SECTION: \_\_\_\_\_  
(Sta.-Sta., Line No., etc.)

Length (Sta.-Sta.) Time-Start/End	Line Size/Type (Inch)	Pipe Pressure Rating (PSI)	Test Pressures (PSIG)	Observed Pressure Range (PSIG)	Total Leakage (Gal./2hrs.)	Allowable Leakage (Gal./2hrs.)

THE TEST AND ATTACHED INFORMATION IS CERTIFIED BY:

Signature/Printed Name: \_\_\_\_\_

Organization/Address: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

TEST RESULTS CHECKED AND APPROVED ON: \_\_\_\_\_  
Date

BY: \_\_\_\_\_ PASSED \_\_\_\_\_ FAILED \_\_\_\_\_  
NTUA Representative

COPY OF APPROVAL OF TEST SENT TO: \_\_\_\_\_  
Project Agency Involved

ON \_\_\_\_\_ BY \_\_\_\_\_  
Date NTUA

**EXHIBIT B OF TP-3**  
**WATER LINE PRESSURE TEST WORKSHEET 1**

Allowable Leakage:  $Q = \frac{ND(P)^{1/2}}{7400}$

Q = Gallon per Hour

N =  $\frac{\text{Total Length of Line Being Tested (ft)}}{\text{Standard Length of Pipe (ft)}} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

D = Nominal Diameter of Pipe (inches) =  $\underline{\hspace{2cm}}$

P = Test Pressure (psig) =  $\underline{\hspace{2cm}}$

Allowable Leakage (2 Hour Test) =  $2Q = \frac{ND(P)^{1/2}}{7400} \times 2 = \underline{\hspace{2cm}}$  (Gals.)

Are the pressure gauges graduated at a maximum of 5-PSI increments?  $\underline{\hspace{2cm}}$

Was the line pressured to 10 PSI above the test pressure so that the gauge responsiveness could be observed?  $\underline{\hspace{2cm}}$

Is the length of the test section less than one mile?  $\underline{\hspace{2cm}}$

Is the elevation difference between the highest and lowest points in the test section less than 57 feet?  $\underline{\hspace{2cm}}$

Are the pipes in the test section the same pressure rating?  $\underline{\hspace{2cm}}$

Description of Activity:	Time:	Gauge Readings:	Amount of Water Added:
Total Time:	Hrs.		Total: Gals.

Verified By:  $\underline{\hspace{2cm}}$   
 NTUA Representative/Date

$\underline{\hspace{2cm}}$   
 Print Name/Title



**EXHIBIT C OF TP-3**

**WATER LINE PRESSURE TEST WORKSHEET 2**

Test Section: \_\_\_\_\_  
(Sta-Sta, Line No., Etc.)

Length (Sta.-Sta.)  Time: Start & End	Line Size & Type  (Inch)	Pipe Pressure Rating  (PSI)	Test Pressure  (PSIG)	Observed Pressure Range  (PSIG)	Total Leakage  (Gal./2hrs.)	Allowable Leakage  (Gal./2hrs.)

## **TECHNICAL PROVISIONS 4.0**

### **TP 4.0 WASTEWATER MAINS AND APPURTENANCES**

#### **4.01 Scope of Work**

The work covered by this section includes the furnishing of all labor, equipment, and material; performing all operations in connection with the construction of gravity wastewater mains and service lines, including manholes and other appurtenances, in accordance with these technical provisions and applicable drawings.

#### **4.02 General**

The wastewater line shall be constructed in the location and to the grade and size shown on the drawings or as directed in writing by the NTUA. Excavation, trenching, and backfilling shall be in accordance with TP 1.0 of these specifications. Inspection of wastewater lines and manhole connections shall be accomplished before backfilling, but work covered by this section will not be accepted until backfilling has been completed satisfactorily. Any section of wastewater that is found defective in material, alignment, and/or grade shall be corrected to the satisfaction of the NTUA and the NMDOT.

#### **4.03 Materials**

##### **4.03.01 Polyvinyl Chloride (PVC) Wastewater Pipe**

Except for extensions to dead ends of 400 feet or less where 6-inch is permitted, minimum wastewater main pipe size and slope, shall be 8-inch nominal diameter at 0.4% slope; and minimum wastewater service pipe size shall be 4-inch nominal diameter at 2.0% slope. All PVC wastewater pipe shall be made of materials conforming to the requirements of ASTM-D1784, Type I, Grade I for Rigid Polyvinyl Chloride compounds. The PVC wastewater pipe shall be SDR 35, Type PSM, with elastomeric gasket joints and shall meet the requirements of ASTM-D3034. The pipe shall have an integral bell with a solid cross section rubber ring, which has been factory assembled and securely locked in place to prevent displacement. Standard lengths shall be 20 feet.

##### **4.03.02 Polyvinyl Chloride (PVC) Wastewater Pipe Fittings**

All PVC wastewater pipe fittings shall be SDR 35, Type PSM, with elastomeric gasket joints and shall meet the requirements of ASTM D-3034. Service connections to new wastewater mains shall be wye fittings. Connections to existing wastewater mains may be wye saddles.

#### **4.03.03 Ductile Iron Wastewater Pipe**

Ductile Iron Pipe shall meet the requirements of AWWA C151, with either mechanical or push-on joints, with an interior lining of 40-mil polyurethane or ceramic epoxy and an exterior of standard bituminous coating. Thickness shall be Class 52 in all sizes.

#### **4.03.04 Ductile Iron Wastewater Pipe Fittings**

Service connections to ductile iron pipe shall be via saddle-type fittings equal to the " or AOE. Connections between wastewater PVC pipe and ductile iron pipe shall be via the appropriate size Calder coupling; however, the ductile iron pipe should be extended from manhole to manhole to minimize the use of adapters.

#### **4.03.05 Pre-cast Concrete Manhole Sections**

Manhole sections shall conform to ASTM C 478. A polyisoprene rubber connector meeting the material and performance requirements of ASTM C-923 and equal to the "A-Lok" Connector as manufactured by A-Lok Products Inc., Trenton, N.J., shall be used to seal between the pre-cast manhole and the sewer pipe. "Ram-Nek" flexible gasket or the "Butyl-Lok" preformed sealant tape by A-Lok Products, Inc., or an approved equal shall be used to seal between manhole sections, grade rings, and cover ring. Bottom manhole sections shall have integral pre-cast base or reinforced concrete floor slabs.

#### **4.03.06 Manhole Covers and Frames**

The frames and covers shall be cast iron, equivalent to a Deeter 1257, 330 pounds, with a Type C surface pick slot. The cover minimum opening shall be 24-inches in diameter with a 6-inch high ring. The lid shall not have any holes including pick holes, which penetrate the entire thickness of the lid. A ¾"-inch by 2-inch by 2-inch recessed slot with a ½-inch diameter pin, crossing the small dimension and centered along the long dimension, shall be provided in the lid, in lieu of a pick hole.

#### **4.03.07 Manhole Steps**

Manhole steps shall be made of ½-inch steel rod encapsulated with copolymer polypropylene or approved equal and shall conform to ASTM C478. The ALCO 12653A aluminum step is also acceptable. Steps shall have minimum projections of 4-inches, spaced no more than 16-inches apart, minimum overall widths of 14-inches, and thoroughly anchored into the walls.

#### **4.03.08 Concrete**

All concrete in addition to the concrete used in precast sections shall have a compressive strength of not less than 3,000 pounds per square inch at 28 days of age. The aggregates, Portland cement, and concrete shall comply with the provisions of ASTM C144 and C33, ASTM C150, Type II. The concrete mix shall be approved by the Owner and shall include no less than 5-1/2 bags of Portland cement per cubic yard. When directed by the Owner, the Contractor shall have compressive strength tests made of the concrete in accordance with ASTM Standard Specifications.

#### **4.03.09 Wastewater Cleanout and Frame**

Where required on the plans, a Neenah R1791A or approved equal cast iron cleanout cover and frame shall be used on all 8-inch wastewater cleanouts.

### **4.04 Installation of Wastewater Pipe**

#### **4.04.01 Pipe Laying**

All trenching, excavation, and backfilling shall be performed in accordance with TP 1.0 of these specifications. The bottom of the trench shall be shaped to give substantial uniform bearing and support for each section for the entire length of the pipe. Bell holes shall be excavated to provide a minimum clearance of 2 inches below the coupling or bell. Pipe laying shall proceed upgrade, with the spigot end pointing in the direction of the flow. Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with the adjoining pipe. As the work progresses, the interior of the sewer shall be cleared of all dirt and superfluous materials of every description. If the maximum width of the trench at the top of the pipe specified in TP 1.0 of these specifications is exceeded for any reason other than by direction, the Contractor shall install such concrete cradling, encasement, gravel base or other bedding as may be required to satisfactorily support the added load of the backfill.

Trenches shall be kept free from water and the pipe shall not be laid when conditions of the trench or the weather are unsuitable for such work. At all times when work is not in progress, all open ends of pipe and fittings shall be securely closed so that no trench water, earth, or other substances will enter the pipe.

#### **4.04.02 Depth of Bury**

All sewage collection lines shall be ductile iron if less than 3 feet of cover is provided within streets and less than 2 feet of cover is provided in all other areas.

#### **4.04.03 Installation of Service Connections**

Wye fittings shall be provided and installed for sewer service connections to new sewer mains. Service saddles are not appropriate for service connections to newly constructed sewer mains but may be used for connections to existing sewer mains. The wye shall be installed such that it is at about a 45-degree angle with the vertical.

### **4.05 Manhole Installation**

#### **4.05.01 General**

Manholes shall be installed in the locations shown on the plans and shall be constructed in accordance with the standard details. Manholes shall be spaced no more than 400 feet apart, and shall be installed at every change in grade, pipe size, or direction.

The invert channel shall be smooth and U-shaped. The lower portion shall conform to the inside of the adjacent sewer section and the upper portion shall be greater in height than the diameter of the largest pipe. A minimum invert elevation drop of 1/10 of a foot from the entrance to the outlet shall be provided in all manholes where there is a change in direction or grade. Changes in size and grade of the channel shall be made gradually and evenly. The invert channel may be formed directly in the concrete, or where there is no change in grade or direction between incoming and outgoing sewers, may be constructed by laying a full section of sewer pipe through the manhole and cutting out the top half after the surrounding concrete has hardened.

The floor of the manhole outside the channel shall be smooth and shall slope toward the channel not less than one inch per foot and not more than 2-inches per foot. Drop inside the manhole shall not exceed 2 feet, measured from the invert of the inlet pipe to the invert of its corresponding channel. If the drop exceeds 2 feet, then a drop manhole shall be installed. A channel must be formed in the concrete of an ogee shape so there is no free drop. Joints between manhole sections, adjustment rings, and cover rings shall be sealed with Ram-Nek flexible gasket or approved equal; and a concrete collar shall be installed in accordance with the standard details.

All sewers extending from manholes shall be supported with compacted gravel from where the sewer pipe leaves the manhole to where the pipe is supported by undisturbed soil.

#### **4.05.02 Connection to Existing Manhole**

The Contractor shall obtain a tapping permit from the NTUA prior to making connections to existing manholes. The connection to the existing manhole shall be made in accordance with the approved plans. Care should be exercised when connecting to the existing manhole so that limited fracture and cracking will occur on the existing manhole. Also, placement of the new wastewater main should be correctly aligned to the invert elevation so as to allow for proper flow of sewage through the manhole. Excessive damage to the existing manhole or improper installation of the new wastewater main, as determined by the NTUA, shall be cause for replacement of the existing facilities within the construction area by the Contractor. This replacement shall be done to the satisfaction of the NTUA and NMDOT.

#### **4.06 Wastewater Main Crossings**

##### **4.06.01 Wash Crossings**

Wastewater mains shall be installed as shown on the approved plans. The Contractor shall divert surface flows, conduct dewatering, and perform all steps necessary to maintain proper bedding conditions and alignment.

##### **4.06.02 Road Crossings**

In lieu of boring, the roadway may be open cut for sewer line within casing installation. The original surface pavement on all open cut roadways shall be either cut square or sawed straight. As with open cut, if boring is required, the steel casing shall be extended from right of way to right of way. The Contractor shall obtain written permission from the appropriate agency prior to beginning any roadway excavation. Backfill within the limits of a roadway prism may require special compaction in accordance with the roadway crossing permits.

Surfacing shall be replaced where the roadway has gravel, concrete, or asphaltic paving in the same thicknesses as were removed, or as specified by the Owner, and completed as soon as possible following backfilling.

PVC wastewater line road crossings shall be installed within steel casing on acceptable casing chocks or redwood skids secured to the pipe

with stainless steel straps. Ductile Iron pipe resting on the bells also may be used as the carrier pipes. The casing ends shall be sealed with an approved rubber boot or 9 mil plastic sheeting with stainless steel clamps. Casing pipe shall be straight welded SCH 10 steel pipe 1/4" wall unless otherwise specified. An alternative method for roadway crossing is to install ductile iron pipe, Class 52, bell and spigot, direct bury by open cut excavation from right of way to right of way. This would be considered when crossing minor roads or trails, or for congested area within an urban setting.

A manhole shall be installed on each side of the roadway right of way, unless specified otherwise. The minimum grade of all road crossings should be 1.0% unless exempted by the NTUA and the NMDOT.

#### **4.07 Sewer Service Line Installations (Not part of the Utility company's facilities)**

##### **4.07.01 General**

All trenching, excavating, and backfilling should be performed in accordance with TP 1.0 and TP 2.0 of these specifications. All new construction shall provide a minimum slope of 1/4-inch per foot (2%) and maintain at least 2 feet of cover over the line. Clean outs should be placed at the house, at any in-line bend greater than 45 degree, and at 100-foot intervals. Bends greater than 45 degrees are discouraged. Services should not enter a manhole but should enter the main line at least 10 feet either side of the manhole.

##### **4.07.02 Connection to Wyes or Main**

Sewer service lines should be connected to the sewer wyes provided with the new sewer main. If connecting to an existing main without existing wyes, the connections shall be made with wye saddles. The Contractor shall obtain from the Operating Utility tapping permits before making sewer service connections to existing sewer mains. The saddle shall be aligned on the sewer main such that it is at about a 45 degree angle with vertical and in no case shall deviate, by more than 15 degrees from either side of 45 degrees without prior approval. During the installation of the sewer saddle, the Contractor shall not allow the pipe cutout or other foreign objects to enter the sewage collection system.

#### **4.08 Wastewater Line Testing**

##### **4.08.01 Alignment Test**

The Contractor shall notify the NTUA two working days in advance of

the date that the Contractor is ready for inspection of sewer alignment. The wastewater main shall be checked by the Contractor and verified by the NTUA, to determine whether any displacement of the pipe has occurred, after the trench has been backfilled to 2 feet above the pipe and tamped as specified. The test shall be made as follows: A light shall be flashed between ends of line by means of a flash light or reflected light. Any deviation from true line or grade, causing less than a full lamped circle, may be cause for rejection. Any ponding of water in the wastewater line may be cause for rejection. A full lamp circle is when a full circle of light is seen from any position around the pipe perimeter.

#### **4.08.02 Deflection Test**

The maximum allowable deflection (reduction in vertical inside diameter) for PVC pipe shall be five percent. Deflection testing may not be required in all cases; however, the NTUA reserves the right to require the Contractor to perform random deflection tests. If three successive tests are determined to be unsatisfactory, the Contractor shall perform deflection tests on the entire project. All locations with excessive deflection shall be excavated and repaired by re-bedding or replacement of pipe. Acceptable methods of deflection testing include use of properly sized go-no-go mandrels or other proposals suitable to the operating utility.

#### **4.08.03 Ex-filtration Test**

The Contractor shall conduct an ex-filtration test on each section of wastewater mains between manholes. The Contractor shall provide at his own expense all necessary equipment and materials required for the tests. One of the following testing methods shall be used.

Air Testing: Testing equipment shall be equal to the “Air-Loc” low pressure air testing system manufactured by Cherne Industrial, Inc. of Edina Minnesota. The gauge used for the air test shall have a minimum division of 0.10-PSI.

Testing shall be conducted in accordance with ASTM C924 (Testing Sewer Lines by the Low-Pressure Air Test Method), except as modified herein. Air testing shall be done between consecutive manholes throughout the entire length of the installed line. Air shall be added to the plugged test section until the internal air pressure reaches 4.0 psig. At least two minutes shall be allowed for the air pressure to stabilize. The air supply shall then be disconnected and the time required for the pressure to drop from 3.5 to 3.0 psig shall be measured with a stopwatch. No one shall enter a manhole when a line into it is



pressurized. If the groundwater level is above any portion of the test section, the test pressure shall be increased, by an amount equal to the average hydrostatic pressure of the groundwater.

The test section will be accepted if the time required for the pressure to decrease from 3.5 to 3.0 PSIG is equal to or greater than the time in the following table. The pipe diameter shall be based on the nominal size of the sewer main. If the time measured is less than the time specified in the table, the Contractor shall locate and repair any leaks and retest the sewer until it is acceptable.

Minimum Duration for Pressure Drop (400 feet Max.)	
Pipe Diameter (Inches)	Time (Minutes)
4	2.5
6	4.0
8	5.0
10	6.5
12	7.5

The following formula should be utilized to determine the minimum duration for pressure drop for test sections greater than 400 feet or pipe sizes greater than 12 inches.

$$T = 0.000371 \cdot D^2 \cdot L \div 2$$

Where: T = Time in Minutes

D = Nominal Diameter in Inches

L = Pipe Length in Feet

Water Testing: One gallon of water may be lost in 2 hours, per each section between manholes, when testing any size main up to 12-inches. The line shall not be tested with the manhole. At least 4 feet of head shall be used for the test. Service lines need not be tested, but they must be plugged to conduct the test of the main. If any leakage in excess of the allowable occurs in any section of the sewerline, that section(s) shall be repaired and re-tested after the leaks are located.

#### **4.08.04 Groundwater Infiltration**

Infiltration of groundwater in excess of 200 gallons per day per inch diameter per mile of wastewater line indicates that the line is not

watertight. Infiltration less than this amount does not relieve the Contractor of the requirement to perform ex-filtration testing. If excess infiltration is noted after ex-filtration tests have been completed, it shall be considered as evidence that the original test was in error or that subsequent failure of the pipeline has occurred.

#### **4.09 Manhole Testing**

Manholes shall be tested for water tightness. Each manhole shall be tested by itself. All lift holes shall be plugged with an approved non-shrink grout. All mains into and out of the manhole shall be plugged with a suitable device. If the manhole fails the initial test, necessary repairs shall be made and the manhole shall be retested. One of the following methods shall be used.

Vacuum Testing: Vacuum testing should be conducted, in accordance with ASTM C1244 (Vacuum Test for Concrete Manholes), except as modified below. The vacuum test head shall be placed inside the top section and the seal inflated in accordance with the manufacturers' recommendations. A vacuum of 10-inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9-inches. The manhole shall pass if the time is greater than 60 seconds for 48-inches diameter, 75 seconds for 60-inches, and 90 seconds for 72-inches diameter manholes.

Hydrostatic Testing: Hydrostatic testing shall be conducted in accordance with ASTM C969, except as modified below. The manhole shall be filled with water to the ring. The maximum loss shall be 5 gallons in a 2-hour test regardless of the manhole depth. The amount of loss shall be determined by measuring the volume of water required to maintain the water level in the manhole within 2-inches of the top of the cone or flat top throughout the entire duration of the 2-hour test.

#### **4.10 Observation of Pressure Tests**

The NTUA is to witness the pressure testing of wastewater lines and manholes. Prior to the test, the Contractor shall have all equipment set up, completely ready for operation and shall have previously successfully performed the test to verify that the test section or manhole will pass. The Contractor shall notify both the NTUA and the NMDOT, a minimum of two working days in advance of the date that the Contractor plans to perform the pressure tests. The Contractor will complete the required certification forms and submit them to the NTUA for approval. A copy of the approval or disapproval of the test results will be sent from the NTUA to the Contractor (see "Exhibit A & C of TP-4).

**EXHIBIT A OF TP 4.0**

**WASTEWATER MAINLINE/MANHOLE WATER TEST 1 CERTIFICATION**

LOCATION OF LINE TESTED: \_\_\_\_\_  
Include Project's Name & Number

DATE(S) TEST WAS CONDUCTED: \_\_\_\_\_

STANDARD LENGTH OF PIPE IN TEST SECTION: \_\_\_\_\_ FEET.

THE TEST AND INFORMATION IS CERTIFIED BY:

Signature/Printed Name: \_\_\_\_\_

Organization/Address: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

WASTEWATER TEST 1 RESULTS CHECKED AND APPROVED ON: \_\_\_\_\_  
Date

BY: \_\_\_\_\_  
NTUA Representative

PASSED \_\_\_\_\_ FAILED \_\_\_\_\_

COPY OF APPROVAL OF THE TEST SENT TO: \_\_\_\_\_  
Project Agency Involved

ON \_\_\_\_\_ BY \_\_\_\_\_  
Date NTUA

**EXHIBIT B OF TP 4.0**

**WASTEWATER MAINLINE/MANHOLE WATER TEST 1-WORKSHEET**

LOCATION OF LINE TESTED: \_\_\_\_\_  
Include Project Name & Number

DATE(S) TEST WAS CONDUCTED: \_\_\_\_\_

(Allowable Leakage: 1 gal/section/2 hrs. for 8" PVC to 12" PVC, regardless of length, using 4-feet of head test pressure.)

**SEWER MAIN**

Sewer Main (MH# to MH#)	Size (in)	Length (ft.)	Actual Leakage (gal.)	Pass/Fail (P or F)	Remarks

Verified By: \_\_\_\_\_  
NTUA Representative/Date

\_\_\_\_\_  
Print Name/Title

(Allowable Ex-filtration: 5 gal./MH/2 hrs. regardless of height. Lamp testing shall be conducted at completion of final grading.)

**SEWER MANHOLE**

Manhole No.	Station	Actual Leakage (gal.)	Pass/Fail (P or F)	Remarks

Verified By: \_\_\_\_\_  
NTUA Representative/Date

\_\_\_\_\_  
Print Name/Title

**EXHIBIT C OF TP 4.0**

**WASTEWATER MAINLINE/MANHOLE AIR/VACUUM TEST 2 CERTIFICATION**

LOCATION OF LINE TESTED: \_\_\_\_\_  
Include Project Name & Number

DATE(S) TEST WAS CONDUCTED: \_\_\_\_\_

THE GAUGE USED FOR TESTING SHALL HAVE MIN. DIVISION OF 0.10 PSI.

STANDARD LENGTH OF PIPE USED ON THIS PROJECT IS \_\_\_\_\_ FEET.

THE TEST AND ATTACHED INFORMATION IS CERTIFIED BY:

Signature/Printed Name: \_\_\_\_\_

Organization/Address: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

WASTEWATER TEST 2 RESULTS CHECKED AND APPROVED ON: \_\_\_\_\_  
Date

BY: \_\_\_\_\_  
NTUA Representative

PASSED \_\_\_\_\_ FAILED \_\_\_\_\_

COPY OF APPROVAL OF THE TEST SENT TO: \_\_\_\_\_  
Project Agency Involved

ON \_\_\_\_\_ BY \_\_\_\_\_  
Date NTUA

**EXHIBIT D OF TP 4.0**

**WASTEWATER MAINLINE/MANHOLE AIR/VACUUM TEST 2 WORKSHEET**

LOCATION OF LINE TESTED: \_\_\_\_\_  
 Include Project's Name & Number

DATE(S) TEST WAS CONDUCTED: \_\_\_\_\_

Air testing shall be conducted between consecutive manholes. The test section shall be acceptable if the time required for the pressure to drop from 3.5 to 3.0 PSIG is greater than or equal to the time in the "Minimum Duration for Pressure Drop" table of TP-4.08.03.

**SEWER MAIN AIR TEST**

Sewer Main MH# to MH#	Size (in.)	Length (ft.)	Start Test Pressure (Psig)	Stop Test Pressure (Psig)	Elapsed Time (Min/Sec.)	Pass/Fail (P or F)	Remarks

Verified By: \_\_\_\_\_ Date: \_\_\_\_\_

Title/Company: \_\_\_\_\_

Manhole shall pass if time is greater than 60 seconds for 48" Dia. MH, 75 seconds for 60" Dia. MH, and 90 seconds for 72" Dia. MH.

**MANHOLE VACUUM TEST**

Manhole No.	Station	Start Vacuum of 10" of Mercury (Inch)	Stop Vacuum (Inch)	Elapsed Time (Min/Sec.)	Pass/Fail (P or F)	Remarks

Verified By: \_\_\_\_\_ Date: \_\_\_\_\_

Title/Company: \_\_\_\_\_

\* Lamp test shall be conducted after completion of street construction and final grading.

**TP 4.11 Individual Subsurface Disposal Systems (Not part of the Utility Company's Facilities)**

**4.11.01 General**

The Contractor shall install individual subsurface disposal systems at the locations shown on the plans. The work shall consist of furnishing and installing a double compartment 1,000-gallon or larger septic tank, 4-inch sewer pipe, and leachfield system in accordance with these technical provisions and applicable drawings. All construction will be done in a workmanlike manner. All sites will be left with a neat appearance.

**4.11.02 Septic Tanks**

**4.11.02.01 General**

All septic tanks shall have a minimum liquid capacity of 1,000 gallons and double compartment. Liquid capacity shall be split with two-thirds in the first compartment and one-third in the second compartment. The liquid depth of the septic tanks shall be at least 4 feet but not more than 5 feet.

The inlet and outlet on all tanks shall be provided with vertical tee fittings of cast iron or PVC plastic. In concrete tanks, oval box shaped or slab type baffles of pre-cast reinforced concrete with a minimum thickness of 2-inches may be used. The inlet baffle or tee must penetrate at least 5-inches below the liquid level but in no case shall it be greater than the penetration of the outlet baffle or tee. Both inlet and outlet baffles or tees shall extend 6-inches or more above the liquid level and end 1-inch from the underside of the tank top to allow gases to escape. The outlet baffle or tee shall extend below liquid level 40 percent of the liquid depth for rectangular tanks and 35 percent for circular tanks. The common wall passage shall also be located at the 40 percent liquid level depth. The inlet invert should be at least 2-inches above the liquid level in the septic tank. Four copies of drawings indicating pertinent dimensions, type, and location of steel reinforcing in concrete tanks, and important details shall be submitted by the Contractor for approval by the Owner prior to the installation of any septic tank.

**4.11.02.02 Concrete Tanks**

Concrete septic tanks shall be of pre-cast, mechanically vibrated, 4,000 psi minimum strength, watertight concrete containing adequate steel reinforcement to facilitate handling. Minimum wall thickness shall be 3-inches. The top and bottom shall have a minimum

thickness of 4-inches. Minimum steel reinforcement will be No. 3 reinforcing bars spaced 2 feet on centers in both directions in the top, bottom, and sides. The equivalent shall be used around manhole inspection ports and construction joints. Minimum steel reinforcement of the access cover or lid shall be No. 4 rebar spaced 6-inches on center in both direction or equivalent. The manhole and inspection opening covers shall be provided with steel lifting handles of No. 3 or No. 4 rebar.

Tanks shall be free of cracks from casting or handling (including placement). No wire mesh or rebar shall be exposed at any point on the tank interior or exterior.

Adequate access shall be provided into the septic tank either through a removable section or manhole with a minimum of 20-inches in the least dimension. The access manhole may be placed partially over the inlet to serve as an inspection hole; otherwise, inspection openings with a minimum of 7-inches in the least dimension shall be provided above the inlet, outlet, and the inter-compartment piping. The access manhole shall be provided with a 6-inch PVC coupling that extends through the center. A 6-inch diameter inspection pipe shall be installed so that it is connected to the access manhole coupling and extends to a point 12-inches above the ground surface. The pipe shall be 160 psi, SDR 26, PVC, shall terminate above ground surface with a 6-inch slip joint PVC cap, and shall be painted red on those portions above the ground surface.

#### **4.11.03 Septic Tank Installation**

Excavation shall be approximately 1 foot wider and longer than the tank. All tanks shall be set on a smooth level surface. The septic tank shall be placed plumb and true so that the inlet and outlet are at the highest possible elevations and so that the outlet pipe is not less than 2-inches nor more than 5-inches below the inlet pipe. The minimum bury for the septic tank inlet pipe shall be 18-inches. The maximum dirt cover for the septic tank shall be 36-inches. Where over excavation occurs, the bottom shall be raised to final elevation in 6-inch compacted lifts. Any water in the excavation must be removed and elevations checked before setting the tank. After setting the tank, it shall be filled with water to prevent floating. Both the septic tank inlet and outlet lines shall be grouted to the septic tank. Backfill around the tank shall be compacted and shall be sufficient to allow for no settlement.

#### **4.11.04 Sewer Pipe and Fittings**

All 4-inch pipe and fittings, except clean out tees, risers, hub adapters, and plugs, shall be PVC, SDR 35, solvent-weld joints and shall comply with ASTM



Specifications D-3033 and D-3034. All PVC shall be Type 1, Grade 1, PVC 1140 conforming to ASTM Specification D-1784.

Cleanout tees, risers, hub adapters, and plugs shall be PVC/DWV and comply with ASTM Specification D-2665.

#### **4.11.05 Sewer Pipe Installation**

All trenching, excavating, and backfilling shall be performed in accordance with TP 1.0 of these specifications. All construction shall provide a slope of 1/4" per foot (2%) and maintain at least 18-inches of cover over the line between the house and the septic tank. A minimum cover of 12-inches is required between the septic tank and drainfield system. Cleanout tees shall be two-way, 4" x 4" x 4", all solvent-weld hubs, PVC/DWV fittings. Cleanout risers for DWV cleanout shall be 4-inch PVC/DWV and shall terminate 3 to 6-inches above the ground surface with a PVC/DWV 4-inch hub adapter (solvent-weld hub by FIPT) and MIPT plug. Cleanout shall be placed at the house and at any in-line bends greater than 45 degree (bends greater than 45 degrees are discouraged) and at 100 feet intervals.

#### **4.11.06 Drainfield Materials**

##### **4.11.06.01 Gravel**

Drainfield gravel shall comply with the requirements for coarse aggregate under Federal Specification SS-A-281b, "Aggregate; (for Portland-Cement-Concrete", and shall be Size 3 (2" to 1" nominal size). The amount of deleterious substances in the coarse aggregate shall not exceed the limits given in Section 3.2.3 of Federal Specification SS-A-281b.

##### **4.11.06.02 Pipe and Fittings**

All PVC shall be Type 1, Grade 1, PVC 1140 conforming to ASTM Specification D-1784. All 4-inch solid PVC pipe and fittings shall be PVC, SDR 35, solvent-weld joints and shall comply with ASTM Specifications D-3033 and D-3034. All 4-inch perforated PVC pipe shall be solvent-weld joints and shall comply with ASTM Specification D-2729 or D-3033 and D-3034. Perforations shall be 1/2 to 5/8 inch diameter holes on 5-inch centers in two rows spaced 90 to 120 degrees apart.

##### **4.11.06.03 Drainage Fabric**

The drainfield fabric shall be non-woven and composed of polypropylene filaments and shall be inert to biological degradation

and naturally encountered chemicals, alkalies, and acids. The fabric shall have a minimum average grab tensile strength of 120 pounds, a minimum average burst strength of 285 psi, a minimum average coefficient of permeability of 0.3 cm/sec, and a minimum thickness of 60 mils. The drainage fabric shall be equal to the Mirafi 140N non-woven fabric as manufactured by Mirafi, Inc., P.O. Box 240967, Charlotte, North Carolina.

#### **4.11.07 Drainfield Installation**

The trench width in the drainfield shall normally be 24-inches and shall not exceed 36-inches nor be less than 12-inches without the consent of the Owner. Trench bottoms shall be smooth and level from beginning of trench to end. All smeared or compacted surfaces of the trenches or bed shall be raked to expose the natural texture of the soil. All loose material shall be removed from the trench before the gravel is placed. The drainfield trench shall be kept as shallow as possible but with a minimum depth of 24-inches and a maximum depth of 60-inches. Drainfields shall be built so that all lines are looped. Where rock, clay, or ground water are encountered, the Contractor shall immediately notify the Owner and shall cease work on the drainfield installation. The bottom of the trench shall be covered with a 6-inch minimum depth lift of gravel. The lift shall be leveled (but not compacted) by hand to within  $\pm$  1-inch throughout the entire length of the trench. The 4-inch perforated plastic pipe shall then be laid level  $\pm$  1-inch by hand and centered in the trench. After the pipe has been laid, a second 6-inch lift of gravel shall be placed by hand and not compacted. The gravel shall be placed so that it extends 2-inches above the pipe. A layer of synthetic drainage fabric then shall be placed over the gravel and folded up the sides of the trench to prevent backfill soil from coming in contact with the gravel.

The trench shall then be backfilled and not compacted. The top shall then be mounded with a 8 to 12-inch crown and shall not be compacted. No mechanical or vehicular traffic shall be used to compact the trench. Backhoes shall not be allowed on trenches during or after the backfilling operation.

Four, red T-type, steel posts shall be placed at the outside corners of the drainfield. The post shall be driven a minimum of 14-inches into the ground and shall extend a minimum of 36-inches above the ground. The Contractor shall leave the premises in a neat and orderly condition. Excess dirt shall be spread evenly over the ground in the immediate area or disposed of in a manner approved by the Owner.

#### **4.11.08 Gravel-less Drainfield Materials**

The gravel-less drainfield shall consists of interlocking leaching chamber units, opened end plates, and closed end plates constructed from molded high density polyethylene. Gravel-less drainfield components shall be equal to the Infiltrator

as manufactured by Infiltrator Systems Inc., P.O. Box 768, Old Saybrook, CT 06475, or an approved equal.

#### **4.11.09 Gravel-less Drainfield Installation**

In place of perforated pipe and gravel for distribution and storage of waste water, leaching chambers or gravel-less drainfield systems can be employed.

The trench width for a gravel-less drainfield shall normally be 36-inches or as specified by the supplier of system. Trench bottoms shall be smooth and level from beginning of trench to end. All smeared or compacted surfaces of the trenches or bed shall be raked to expose the natural texture of the soil. All loose material shall be removed from the trench before the chamber units are installed. The trench shall be kept as shallow as possible but with a minimum depth of 24-inches and a maximum depth of 36-inches.

The installation of the gravel-less system shall be per the manufacturer's recommendations. Where rock, clay, or ground water are encountered, the Contractor shall immediately notify the Owner and shall cease work on the drainfield installation. The area between the leach chamber and trench wall shall be backfilled and compacted. The minimum cover for the gravel-less drainfield is 12-inches. The top shall then be mounded with an 8 to 12-inch crown and shall not be compacted. No mechanical or vehicular traffic shall be used to compact the trench. Backhoes shall not be allowed on trenches during or after the backfilling operation.

A 4-inch solid sewer PVC-DWV inspection port with adapter hub and plug shall be installed at the end of each line. The Contractor shall leave the premises in a neat and orderly condition. Excess dirt shall be spread evenly over the ground in the immediate area or disposed of in a manner approved by the Owner.

## **TECHNICAL PROVISIONS 5.0**

### **TP 5.0 FINAL SITE UTILITY INSPECTION REQUIREMENTS**

#### **5.01 Final Inspection Package**

The Contractor shall submit a complete site utility inspection package, which shall include the following items; all copies of which shall be legible.

##### **5.01.01 As-Built Drawings**

Four (4) sets of Size D "as-built" drawings which contain:

- A. Cover Sheet
- B. Rights of Way Plat Sheets
- C. Utility Plan View Sheets
- D. Water/Wastewater Plan and Profile Construction Sheets
- E. Details Sheets - Standard and Specific Drawings

##### **5.01.02 As-Built Notebook**

Four (4) three ring, loose-leaf binders, containing the following information:

- A. Water Pressure Test Certification and Test Results Approved by the NTUA. See "Exhibit A" of TP-3.
- B. Wastewater Main and Manhole Test Certifications and Test Results Approved by the NTUA. See "Exhibit A" or "Exhibit C" of TP-4
- C. Executed Transfer Agreement with Cost of Plant attached. See Exhibit "A" and "B" of TP-5.
- D. Water Meter Serial Number Listing and Current Meter Readings.
- E. Approved Tapping Permits.
- F. Approved Water/Wastewater Material Submittals.
- G. A set of plans on CD in the AutoCAD version specified.

#### **5.02 Scheduling Final Inspection**

The scheduling for the final inspection shall be coordinated with the NTUA by the Contractor. A complete as-built package is to be provided to the NTUA for review, a minimum of 21 calendar days prior to the scheduled inspection.

### **5.03 As-Built Drawing Requirements**

Each project site that contains utilities to be transferred to the NTUA must be submitted with the following requirements and sheets.

#### **5.03.01 General Requirements for All Sheets**

**5.03.01.01** Each sheet must be stamped by an A/E\* and prominently labeled, signed, and dated by the Contractor (excepting cover and rights of way sheets):

AS BUILT \_\_\_\_\_  
(Name) (Date)

“I certify that I have constructed this project following the standards set forth in TPs 1 - 4, and I have complied with all vertical and horizontal pipeline separation requirements.”

**5.03.01.02** All facilities shall be shown as constructed and references to "proposed" or "future" deleted.

**5.03.01.03** Where appropriate, each sheet must have a north arrow. Whenever possible, the arrow shall be up or to the right of the sheet.

**5.03.01.04** Where appropriate, each sheet must have a standard legend and bar scale. All existing mains must be solid lines and sewer manholes must be solid circles.

**5.03.01.05** All sheets must be numbered sequentially beginning with “Sheet 1 of (Total) Sheets.”

#### **5.03.02 Cover Sheet**

**5.03.02.01** Since drawings occasionally cover several project sites, the location for each as-built site must be prominently identified by project number and project site location.

**5.03.02.02** A map of the Navajo Nation that shows the project location, a vicinity map with a scale of 1" = 2 miles, and a north arrow is to be provided. These maps may be on a separate sheet or on the topographic boundary sheet.

**5.03.02.03** The project site location, with the project number(s), should be shown on both the Navajo Nation and vicinity maps.

### **5.03.03 Plat Sheet**

**5.03.03.01** Show site boundaries with bearings and distances, complete with ties to permanent state plane markers (Section Corners, established monuments, etc.) and bearing references. All bearings shall be in the appropriate State Plane System in NAD 83 if possible; all distances shall be ground distances. Indicate basis of bearing.

**5.03.03.02** Show and describe location of elevation and vertical datum references. A broken line may be utilized if the benchmark is not within the drawing scope or scale.

**5.03.03.03** Show each lot and street boundary defined with bearings and distances, if appropriate. Show street centerline bearing, distance, and curve data.

**5.03.03.04** Provide statements "Street Rights of Way are Dedicated to the Common Use of Utilities" if appropriate, and "the operating utility is not responsible for the repair or replacements of improvements in utility easements disturbed during operation and maintenance activities."

**5.03.03.05** Show minimum 20-foot wide easements for each utility (electric, natural gas, water, sewers, telephones, cable) not located within the street right of way. Add an additional 10-foot width for each additional parallel utility. The NTUA will provide to the Contractor as-built drawings of utilities not constructed by the Contractor.

**5.03.03.06** Utility or street rights of way may require expansion in localized areas to include all utility appurtenances (e.g., fire hydrant guards), which are not within the normal easement.

**5.03.03.07** Provide a narrative legal description of the site boundary.

### **5.03.04 Utility Plan View Sheet(s)**

**5.03.04.01** On a sheet with a scale between 1"=20' and 1"=50', provide a plan view of the site that shows all utilities (e.g., propane, water, sewers, electric, natural gas, telephones, cable).

**5.03.04.02** Show all lot, street, and easement boundary lines without bearing and distances.

**5.03.04.03** Label all houses with final house numbers. Numbers must be

consistent with a swing tie table.

**5.03.04.04** Provide a legend, north arrow, and bar scale.

**5.03.04.05** Show as-built routing of all water and sewer mains and service lines. Emphasize water and sewer mains by using bolder lines. Use a smaller but bold line for service lines. Reference the standard NTUA legend.

**5.03.04.06** Label water mains with size, type of material, pressure rating, and length of pipe from P.I. to P.I. Example: 6" PVC, SDR 21, 232.00'.

**5.03.04.07** Label wastewater mains with size, type of material, and distances between manholes. Example: 8" PVC, SDR 35, 389.00'.

**5.03.04.08** Label water and wastewater main tap points, to previous projects with previous project number and as-built sheet number. Contractor shall contact the Operating Utility to determine this information.

Examples: White Cone Composite	Red Water Housing
IHS NA 88-114	NHA AZ 12-106
Sheet 15 of 43	Sheet C-8

**5.03.04.09** Show and label depth of bury at all locations where water main varies from the standard depth of bury of 42 inches.

**5.03.04.10** For fire hydrants, gate valves, tees, bends, water meters, curb stops, and saddles state the manufacturer model number and type of joint for the actual item used. As an option this information can be shown on the standard detail sheet next to the appropriate detail, or include submittals.

**5.03.04.11** Show and label all water main fittings actually used. G.V., 6" DI TEE, 6" DI 45° BEND. Examples: 6" G.V., 6" DI TEE, 6" DI 45° BEND.

**5.03.04.12** Provide swing ties in table format for all gate valves, water meters, domestic stops, curb stops, water main taps, manholes, main line clean out, yard clean outs, and sewer wyes. Swing ties shall be measured from building corners or other permanent structures.

**SWING TIES (Examples)**

House No.	Domestic Stop		Water Meter		Curb Stop		Water Main Tap		Yard Clean out		Sewer Wye	
	A	B	A	B	A	B	A	C	A	B	A	C
1	31.6	3.8	34.8	32.9	36.7	35.8	42.0	65.0	22.4	11.6	57.0	73.0

Item	House No.	Distance	
		A	B
MH 11A-3	3	56.2	68.4
GV-1	5	43.4	63.6
GV-2	5	43.6	61.6
MH 11A-1-2	15	93.4	73.0
CO-2	14	64.8	61.5

**5.03.04.13** Label corners of each building or structure, as necessary, to provide references for swing tie tables.



**5.03.04.14.1** Provide pipe information for each size and type of pipe in a table with the following format:

Use	Size (in)	Type of Material	Joint Type	SDR	Pressure Rating PSI	Dimensions (in)			ASTM No.
						O.D.	I.D.	Wall Thick	
Water	6	PVC	Slip	21	200	6.625	5.993	0.316	D2241
Water	1	PE	Stab	7	200	1.349	1.049	0.150	D2239



Sewer	8	PVC	Slip	35	N/A	8.400	7.920	0.240	D3034
Sewer	4	PVC	Slip	35	N/A	4.215	3.975	0.120	D3034

PIPE DIMENSIONAL DATA 5.03.05

**5.03.05 Water/Wastewater Plan and Profile Sheet(s)**

**5.03.05.01 Plan View**

Provide all items from the utility plan view sheet requirements on the Utility Plan View Sheets portion; TP 5.03.04.

**5.03.05.02 Profile View**

**5.03.05.02.01** Label all manholes and wastewater main clean-outs with manholes and clean-out numbers. Provide rim elevations with inlet and outlet invert elevations. The manhole numbers must conform to the existing manhole numbering system. Station all manholes and connections.

**5.03.05.02.02** Label all wastewater mains with size, type of material, slope, and distance. Distance shall be the actual distance of the pipeline. (O.D. of manholes to O.D. of manholes).

**5.03.05.02.03** Show all water mains that cross the sewer main and dimension Pipe O.D. to Pipe O.D. the vertical separation. Station all water mains and appurtenances.

**EXHIBIT A OF TP 5.0**

Note: (This is an example only. The actual Cost of Plant shall be developed by the Contractor and attached to the Transfer Agreement.)

**COST OF PLANT**  
NHA Project AZ 12-51  
Kayenta, Arizona

ITEM	QUANTITY	UNIT	LABOR	MATERIAL	TRANS.	TOTAL
8" PVC Sewer Main	1745	LF	\$7,187.22	\$5,750.00	\$1,437.44	\$14,374.66
Precast Manhole	7	EA.	\$2,101.10	\$1,681.68	\$ 420.00	\$ 4,209.78
8" Sewer Clean out	1	EA.	\$ 123.50	\$ 68.75	\$ 24.75	\$ 216.50
Sewer Service Connection	30	EA.	\$2,415.00	\$1,932.00	\$ 483.00	\$ 4,830.00
					Subtotal:	<u>\$23,630.94</u>
6" PVC Water Main	1707	LF	\$16,438.41	\$13,150.73	\$3,287.68	\$32,876.82
Fire Hydrant	3	EA.	\$ 750.00	\$ 600.00	\$ 150.00	\$ 1,500.00
6" Gate Valves	9	EA.	\$ 948.47	\$ 758.00	\$ 189.00	\$ 1,895.47
1" Water Service Line w/Meters	30	EA.	\$ 6,420.00	\$ 5,136.00	\$1,284.00	\$12,840.00
					Subtotal:	<u>\$49,112.29</u>
<b>TOTAL COST OF UTILITY PLANT:</b>						<u><b>\$72,743.23</b></u>
Less: Sewer Service Connection not transferred to Operating Utility:						<u>-\$ 4,830.00</u>
<b>TOTAL OF PLANT TRANSFERRED:</b>						<u><b>\$67,913.23</b></u>

**EXHIBIT B OF TP 5.0**  
**UTILITY TRANSFER AGREEMENT**  
**FOR**  
**WATER AND WASTEWATER FACILITIES**

This agreement is made between \_\_\_\_\_, hereinafter called the Grantor, and the **NAVAJO TRIBAL UTILITY AUTHORITY**, hereinafter, call the Grantee.

**WHEREAS**, the Grantor has constructed or caused to have constructed water and wastewater facilities located at or near \_\_\_\_\_ as shown on the plans titled \_\_\_\_\_, designed by \_\_\_\_\_, and dated \_\_\_\_\_ and said facilities and related final as-built plans already have been inspected, accepted and approved by the Grantee, and;

**WHEREAS**, the Grantor wishes to convey to the Grantee all his interest in these facilities and appurtenances constructed at the above-mentioned location on or about the above-mentioned time, along with all rights, rights of way, and privileges so that the Grantee may own, operate, and maintain all such facilities and appurtenances.

**NOW THEREFORE IT IS AGREED:**

For consideration of \$1.00, the receipt of which already has been acknowledged, the Grantor transfers, assigns, grants, and conveys to the Grantee all rights, titles, interests, easements, and rights of way in the aforementioned facilities, and;

The Grantee agrees to accept such aforementioned facilities, and further agrees to own, operate, and maintain such facilities in a reasonable and prudent manner until such facilities are determined to be no longer of any value. Further, the Grantor hereby warranties all such facilities against defects in workmanship and materials, and for design deficiencies, errors, and omissions for the period of one year beginning on \_\_\_\_\_ and ending on \_\_\_\_\_.

A listing of the total inventory and Cost of Plant determined by the Grantor, to be transferred to the Grantee, is attached as EXHIBIT \_\_\_\_\_ and made a part of this Utility Transfer Agreement. The total Cost of Plant as appears on this document is \$ \_\_\_\_\_.

**IN WITNESS THEREOF**, both parties have signed and dated this agreement.

Grantor: by \_\_\_\_\_ Date: \_\_\_\_\_  
Signature  
\_\_\_\_\_  
Printed Name

Navajo Tribal Utility Authority: by \_\_\_\_\_ Date: \_\_\_\_\_  
Signature  
\_\_\_\_\_  
Printed Name

**SECTION 33 4100**  
**STORM UTILITY DRAINAGE PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Pipe and fittings.
  - 2. Catch basins.

**1.2 DEFINITIONS**

- A. PE: Polyethylene plastic.
- B. PVC: Polyvinyl chloride plastic.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall have at least a watertight joint, unless otherwise indicated.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. Catch basins. Include plans, elevations, sections, details, frames, covers, and grates.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between piping and proximate structures.
- B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate catch basins and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
- C. Product Certificates: For each type of pipe and fitting, from manufacturer.
- D. Field quality-control reports.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store plastic pipe and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Protect and handle catch basins according to manufacturer's written instructions.

**PART 2 - PRODUCTS**

**2.1 HDPE PIPE AND FITTINGS**

- A. HDPE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252, Type S, with watertight joints.
  - 1. Watertight Joints: ASTM D3212.
  - 2. Gaskets: ASTM F477.
- B. HDPE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294, Type S, or ASTM F2306 with watertight joints.
  - 1. Watertight Joints: ASTM D3212.
  - 2. Gaskets: ASTM F477.

**2.2 CATCH BASINS**

- A. Standard Catch Basins: ASTM D1784 cell class 12454, PVC, of depth indicated, with

1. Size: As indicated.
  2. Joint Tightness: ASTM D3212.
  3. Flexible Elastomeric Seal: ASTM F477.
- B. Frames and Grates: ASTM A 536, Grade 70-50-05, ductile iron.
1. Size: As indicated.
- C. Manufacturer:
1. Drain Basin with frame and grate, as manufactured by Nyloplast, or approved equal.

### **PART 3 - EXECUTION**

#### **3.1 EARTHWORK**

- A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

#### **3.2 PIPING INSTALLATION**

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- D. Install gravity-flow, nonpressure drainage piping according to the following:
1. Install piping pitched down in direction of flow, at minimum slope of 0.5 percent, unless otherwise indicated.
  2. Install piping with 12-inch minimum cover.
  3. Install HDPE piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."

#### **3.3 CATCH BASIN INSTALLATION**

- A. Install catch basins to sizes and shapes indicated and follow manufacturer's written instructions.
- B. Set frames and grates to elevations indicated.

#### **3.4 FIELD QUALITY CONTROL**

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate reports for each system inspection.
  2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  4. Reinspect and repeat procedure until results are satisfactory.

- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  - 4. Submit separate report for each test.
  - 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction.
- C. Test watertightness in accordance with ASTM F2487 by field performance verification.
- D. Leaks and loss in test pressure constitute defects that must be repaired.
- E. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

### **3.5 CLEANING**

- A. Clean interior of piping of dirt and superfluous materials.

**END OF SECTION**